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Building 6630 Hazards Assessment Document

Zeferino Banda, Michael Williams

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550
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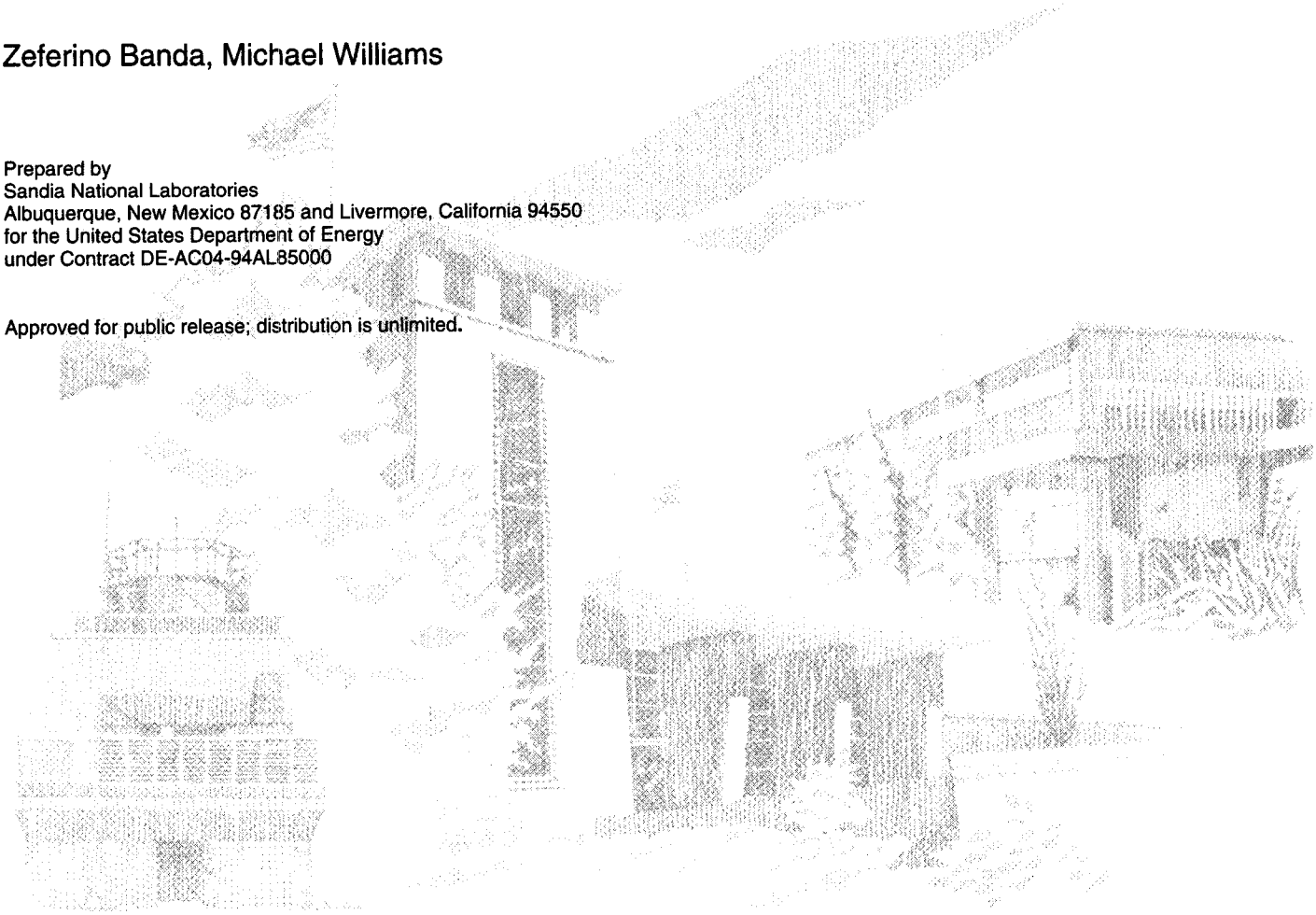

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Building 6630
Hazards Assessment Document

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Sandia National Laboratories
Albuquerque, New Mexico 87185

Sandia Contract No. AL-5473

Abstract

The Department of Energy Order 5500.3A requires facility-specific hazards assessments be prepared, maintained, and used for emergency planning purposes. This hazards assessment document describes the chemical and radiological hazards associated with Building 6630. The entire inventory was subjected to the screening criteria for potential airborne impact to onsite and offsite individuals out of which one chemical was kept for further evaluation. The air dispersion model, ALOHA, estimated pollutant concentrations downwind from the source of a release, taking into consideration the toxicological and physical characteristics of the chemical release site, the atmospheric conditions, and the circumstances of the release. The greatest distance at which a postulated facility event will produce consequences exceeding the Early Severe Health Effects threshold is 76 meters. The highest emergency classification is an Alert. The Emergency Planning Zone is a nominal 100 meter area that conforms to DOE boundaries and physical/jurisdictional boundaries such as fence lines and streets.

EXECUTIVE SUMMARY

This hazards assessment provides an evaluation of the chemical and radiological hazards at Building 6630 as mandated by the Department of Energy (DOE) Order 5500.3A, Comprehensive Emergency Management System.

The hazards assessment process developed scenarios and estimated consequences for those chemical and radiological materials determined to be hazardous. The results were used to develop the following information for use in Sandia National Laboratories/New Mexico (SNL/NM) Emergency Management Program for Building 6630.

- The greatest distance at which a postulated facility event will produce consequences exceeding the Early Severe Health Effects threshold is 76 meters. (This event involves the release of 100 cubic feet of a carbon monoxide).

- The highest emergency classification is an Alert.

- The recommended protective response actions for a release of the carbon monoxide in Building 6630 are evacuation and accounting for personnel.

- The Emergency Planning Zone is a nominal 100 meter area which conforms to DOE boundaries and physical/jurisdictional boundaries such as fence lines and streets (Illustration 7-1).

TABLE OF CONTENTS

APPENDICES

TABLES

ILLUSTRATIONS

KEY to ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ALOHA	Aerial Locations of Hazardous Atmospheres
CAMEO	Computer-Aided Management of Emergency Operations
C	Celsius
CFR	Code of Federal Regulations
C/M	Control Monitor
cm	Centimeter
CRD	Confidential Restricted Data
D_{ESHE}	Distance at which Early Severe Health Effects are reached
DOE	Department of Energy
DOT	Department of Transportation
EAL	Emergency Action Level
EMG	Emergency Management Guide
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
EPZ	Emergency Planning Zone
ERPG	Emergency Response Planning Guidelines
ESHE	Early Severe Health Effects
'	Feet
FEMA	Federal Emergency Management Agency
GE	General Emergency
GVW	Gross Vehicle Weight
HVAC	Heating, Ventilating, and Air Conditioning System
KAFB	Kirtland Air Force Base
kg	Kilograms
km	Kilometer
km^2	Square Kilometer
km/hr	Kilometers per Hour
LANL	Los Alamos National Laboratory
LEL	Lower Explosive Limit
LEPC	Local Emergency Planning Committee
m	Meter
m/km	Meters per Kilometer
m^2	Square Meter
M_L	Maximum Probable Local Magnitude Shock
Mos	Mobile Offices
MSDS	Material Safety Data Sheets
NFPA	National Fire Protection Agency
NOAA	National Oceanic and Atmospheric Administration
PAG	Protective Action Guide
PEL	Permissible Exposure Limit
PHA	Preliminary Hazards Assessment
ppm	Parts Per Million
SAE	Site Area Emergency
SNL/NM	Sandia National Laboratories/New Mexico
SOP	Standard Operating Procedures
TA	Technical Area
TLV	Threshold Limit Value
TWA	Time Weighted Average
UEL	Upper Explosive Limit

1.0 INTRODUCTION

The purpose of the hazards assessment process is to document the impact of the release of hazards at Building 6630 that are significant enough to warrant consideration in Sandia National Laboratories' operational emergency management program. This hazards assessment is prepared in accordance with the Department of Energy Order 5500.3A[1] requirement that facility-specific hazards assessments be prepared, maintained, and used for emergency planning purposes. (DOE Order 5500.3A has been replaced by DOE Order 151.1[2] and will be added to the SNL contract in the future.)

This hazards assessment provides an analysis of the potential airborne release of chemicals associated with the operations and processes at Building 6630. The focus of the hazards assessment is the airborne release of materials because this requires the most rapid, coordinated emergency response on the part of personnel from Building 6630, SNL/NM, collocated facilities, and the surrounding jurisdictions to protect workers, the public, and the environment.

A key objective of DOE's Emergency Management Program is to ensure that all DOE facilities and operations develop and maintain emergency planning, preparedness and response capabilities, as well as effective public and interagency communications; to minimize consequences to workers and the general public from events involving the release of hazardous materials. If planning and preparedness for emergencies is to be adequate and appropriate, then the hazards that are specific to each facility and operation must first be identified and understood. The hazards assessment herein provides the technical basis for such planning.

Building 6630 is located in Technical Area-III (TA-III), approximately 1,630 meters south of the TA-III gate, and approximately 330 meters west of the TA-III fence. The facility is a one-story building with a high-bay and attached temporary office buildings. The facility also contains several outside, detached storage buildings. The building is constructed with a concrete slab foundation, cement masonry unit and corrugated metal walls. The roof is constructed of metal truss, bar joints and metal decking with a built-up roof. The office space interior is finished with vinyl floor tile or carpet, wallboard interior walls and suspended ceilings. Recently, a 548.13 square meter addition was added to Building 6630 to house the Investment Casting Facility. The activities in Building 6630 include melting and casting research for various metals.

All chemical and radioactive materials within Building 6630 have been identified. The entire inventory was analyzed according to the potential to affect onsite and offsite individuals. Those materials that were determined hazardous were fully characterized, accident scenarios were developed, and potential consequences were estimated. The resultant consequences were utilized to determine the appropriate emergency planning zone, emergency classes, and emergency action levels.

2.0 SITE AND FACILITY DESCRIPTION

2.1 SNL/NM Site

Sandia National Laboratories/New Mexico (SNL/NM) is located approximately 10 kilometers (km) east of downtown Albuquerque, New Mexico, in the foothills of the Manzano Mountains (see Illustrations 2.1-1 and 2.1-2). SNL/NM is surrounded by Kirtland Air Force Base (KAFB) and has co-use agreements on some portions of Air Force property. KAFB is located on two broad mesas that are bisected by the Tijeras Arroyo, an east-west trending canyon. These mesas are bounded by the Sandia and Manzano Mountains (Cibola National Forest) to the east and the Rio Grande to the west. Regional elevations range from a low of 1,500 meters (m) at the Rio Grande to a high of 3,255 meters at Sandia Crest. KAFB is at a mean elevation of 1,630 meters.

SNL/NM is operated for the Department of Energy (DOE). It consists of five technical areas (TAs) and remote test areas situated on the eastern half of the 210 square kilometer (km^2) KAFB military reservation (see Illustration 2.1-3). Adjacent to and physically combined with the KAFB is the Albuquerque International Airport, in what constitutes a large joint military and commercial transportation complex. Landing and takeoff patterns for the various runways at the airport facilities are not expected to affect SNL/NM operations. The east-west runway currently is the most used.

2.2 Weather and Climate

SNL/NM temperatures are characteristic of high-altitude, dry, continental climates. Sunshine is a predominant feature of SNL/NM and occurs approximately 75 percent of daylight hours. Maximum daytime temperatures during the winter of 1988 averaged near 10° Celsius (C); summer daytime maximum temperatures averaged less than 32°C except in July when the maximum average reached 34°C.[3] Temperature extremes below -27°C or above 41°C occur infrequently.[4]

The average annual precipitation for SNL/NM is 21 centimeters (cm); half of this precipitation occurs from July through September in the form of convective thundershowers. Winters are typically dry with less than 5 cm of precipitation normally recorded in a given month. This includes occasional snowstorms with accumulations of 20-to-30 cm of snow. The maximum observed precipitation in 24 hours occurred in September, 1983, when 5.7 cm of rain was recorded. The total annual precipitation of 33 cm for 1988 was 12 cm above the 30-year average of 21 cm. The average annual relative humidity recorded from 1951 to 1980 was about 43 percent, with the average humidity dropping to less than 20 percent in April, May, and June.

Strong winds, often accompanied by blowing dust, occur mostly in late winter and early spring. Wind speeds reach a maximum velocity of 51.8 kilometers per hour (km/hr) on an average of 46 days per year. Every two years, a one-minute duration gust of 96.2 km/hr is expected.[5] The average hourly wind velocity at the Albuquerque International Airport recorded from 1951 to 1980 ranged from 12.4 km/hr in December to 17.8 km/hr during April.[6] The annual surface wind speed and direction for SNL/NM are depicted in Illustration 2.2-1. Rapid nighttime ground cooling produces strong temperature inversions as well as drainage winds that flow out of the mountains during evening hours.[7]

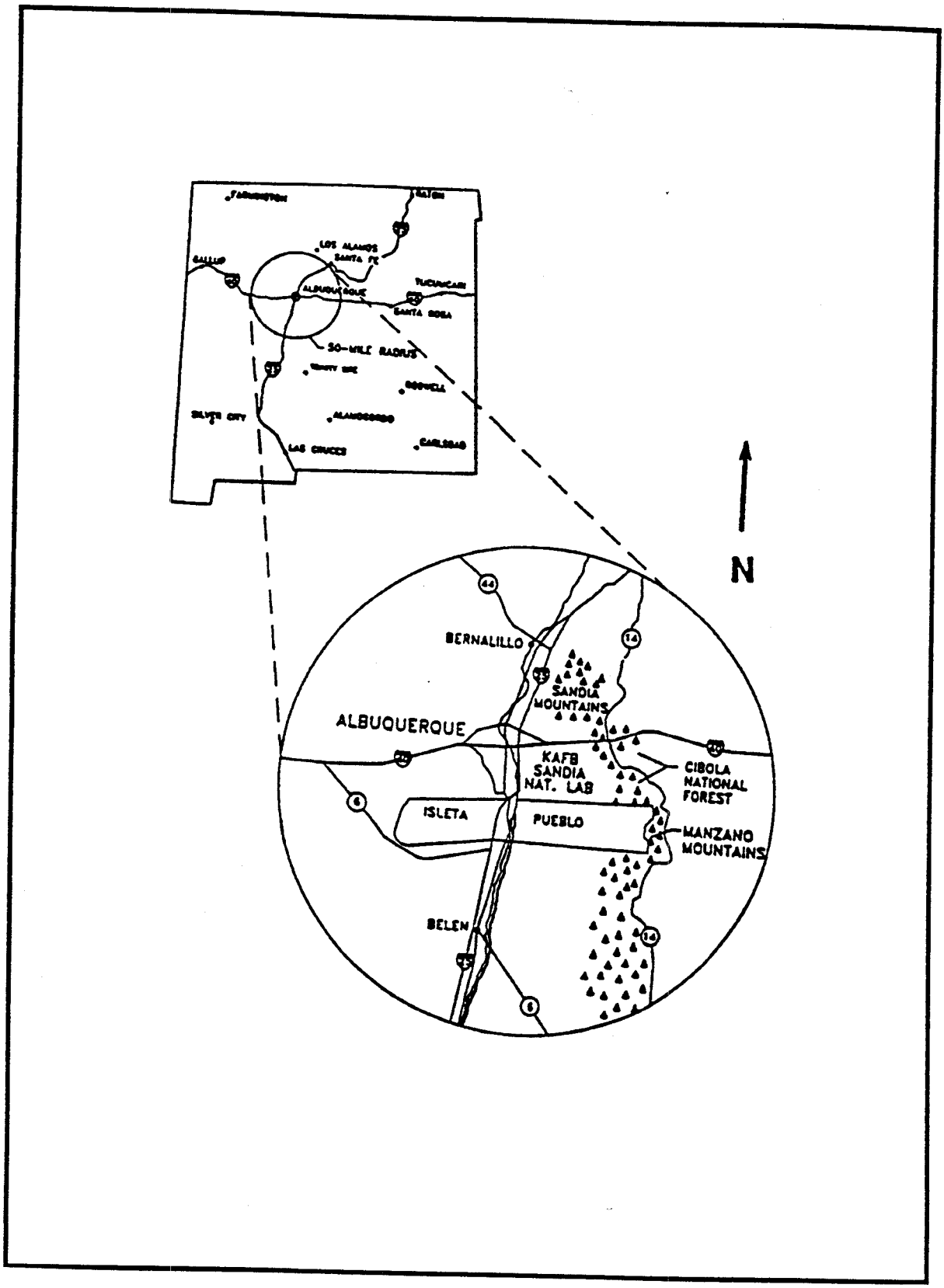


Illustration 2.1-1 General Location Map, Sandia National Laboratories, Albuquerque, NM

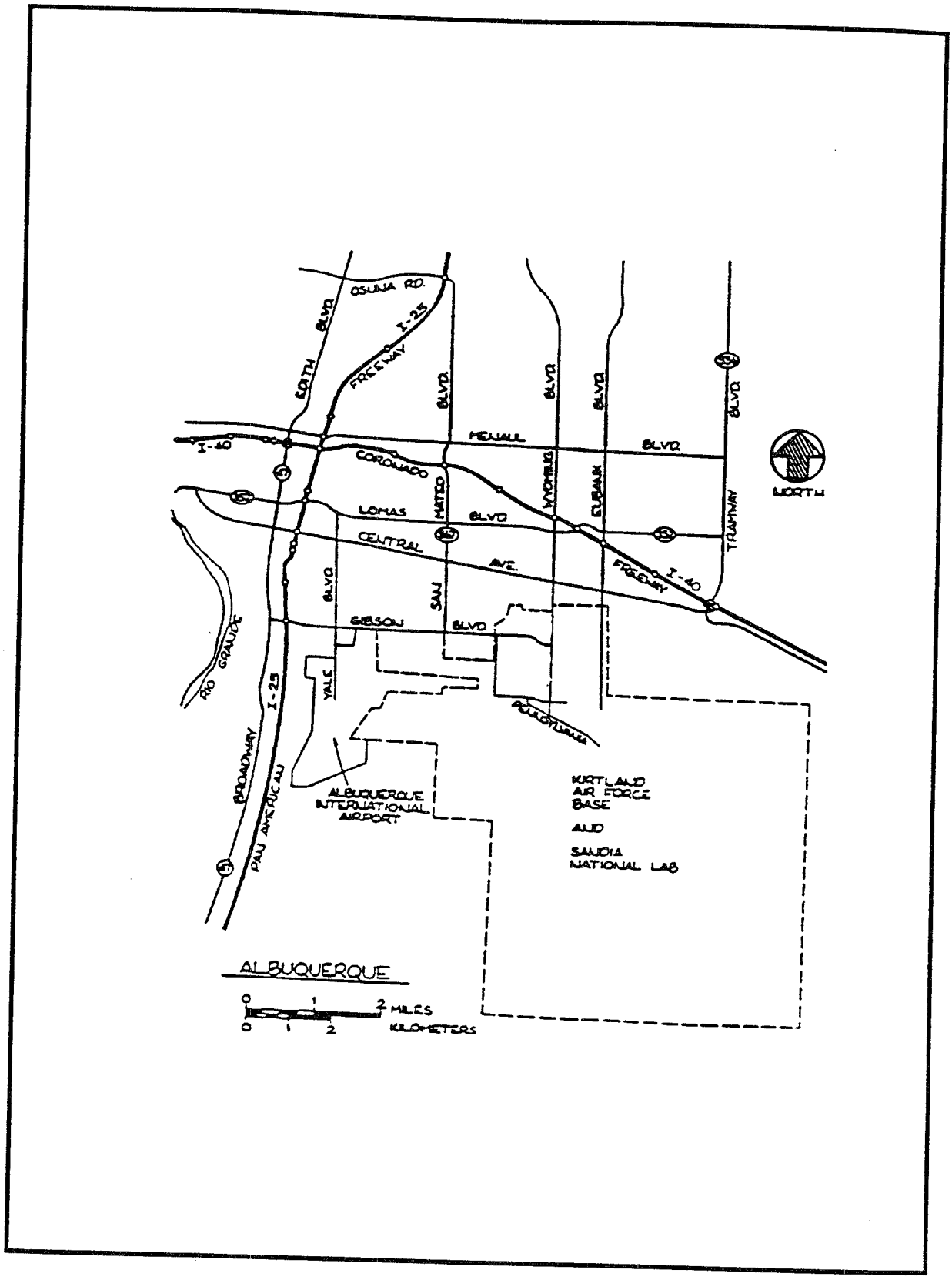


Illustration 2.1-2 Location Map for Sandia National Laboratories/New Mexico

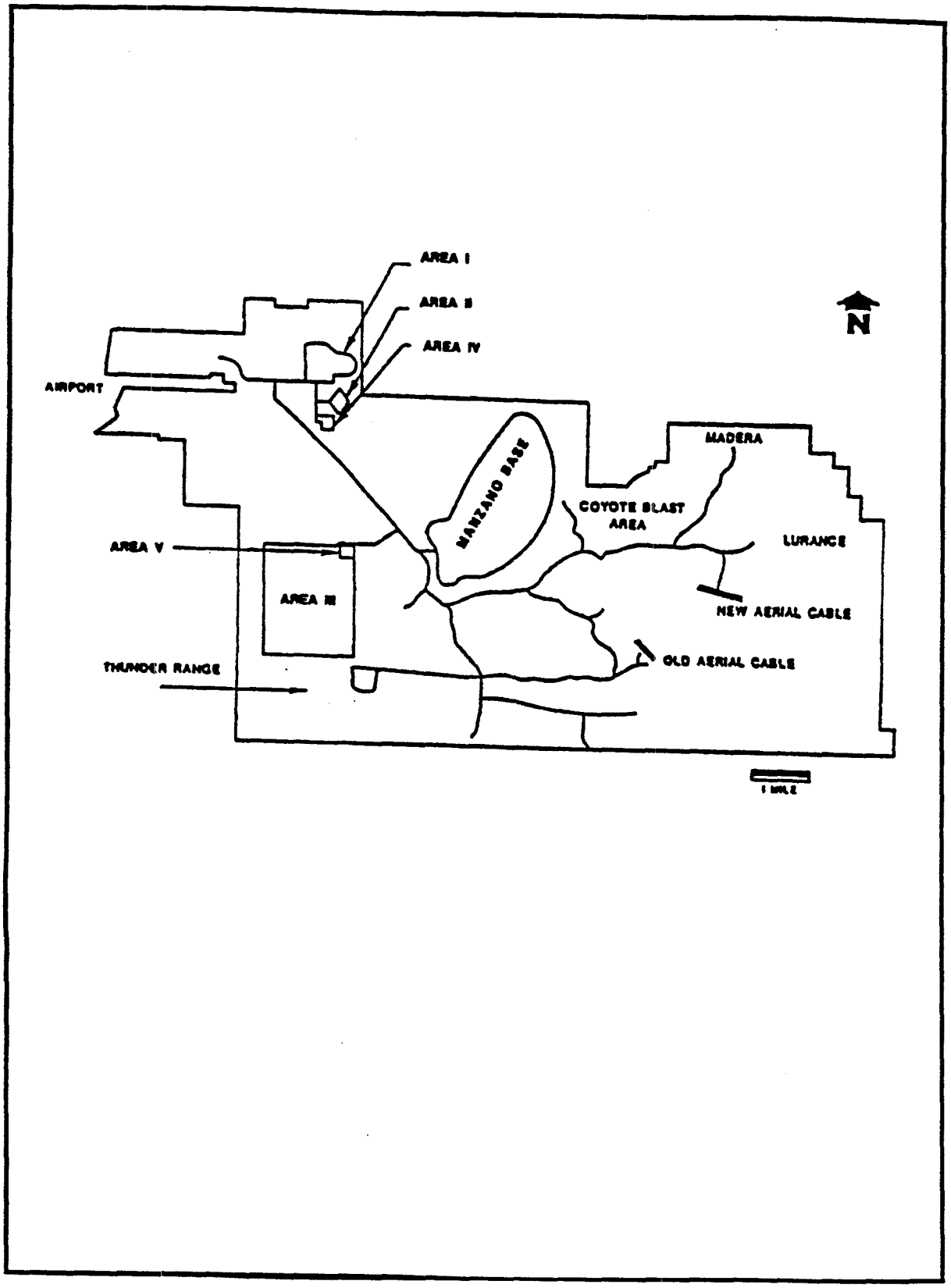


Illustration 2.1-3 SNL/NM Technical Areas

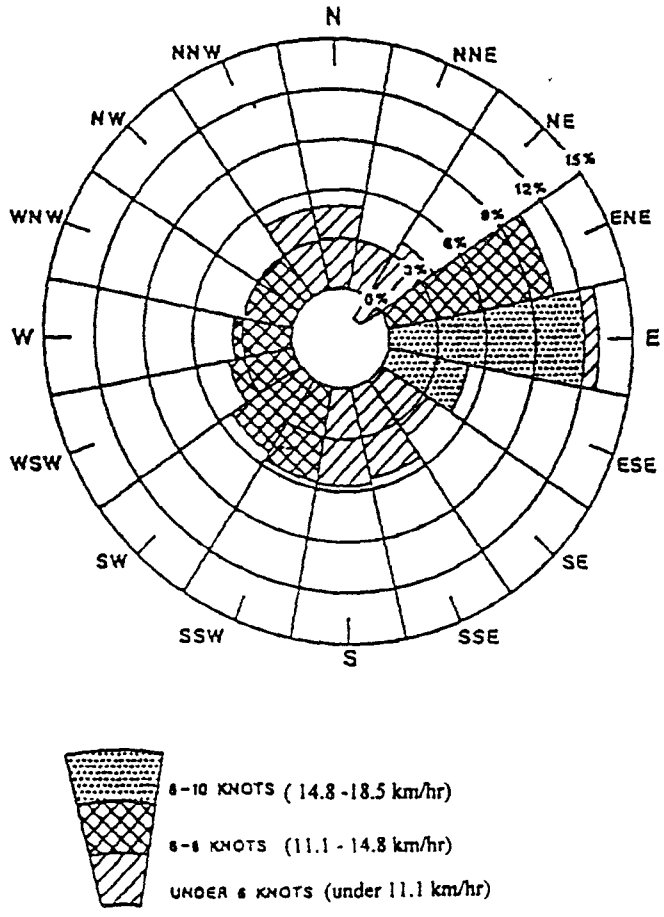


Illustration 2.2-1 Annual Surface Wind Speed and Direction, SNL/NM

Tornado occurrences within the state of New Mexico vary from a minimum annual frequency of 0.2 to a maximum of 1.1.[8] Statistically, the highest frequency has been observed in the eastern half of the state. For the western half of the state, generally demarcated by the Rio Grande River and the mountain ranges that parallel it on the east side, tornado frequencies are 0.3 or less. In the Albuquerque area, which lies west of the Sandia and Manzano Mountains, only two tornadoes have been reported in more than a 20-year span. These occurred within the center of the city of Albuquerque in the years 1985 and 1987 and are officially listed in the climatological records of the National Weather Service as "small tornadoes." Damage was light and no official wind readings are available.

In addition, one funnel cloud has been observed in the same 20-year period. This was reported in the Four Hills area of Albuquerque about 2 km to the east of Technical Area I (TA-1) on KAFB, but it was not observed to touch down and accordingly, it did not cause any reported damage. Based on the climatological records available, Albuquerque can be classified as a region of low occurrence with an annual frequency of 0.1 or less.

2.3 Air Quality

The air quality at SNL/NM is strongly influenced by the presence of the Albuquerque metropolitan area to the north and west.

SNL/NM is situated in the Rio Grande Valley, which is flanked by the Sandia and Manzano Mountains on the east and the Puerco Plateau on the west. This protects the Rio Grande Valley from many passing storms and reduces much of the air flow that would carry air pollution away from the metropolitan area.[9] During many winter nights, the air in the metropolitan area becomes very stable and still, creating a temperature inversion which traps the pollutants emitted into the colder air at ground level. During the winter months, Albuquerque occasionally exceeds the ambient standards for carbon monoxide. Air quality has been improving, with fewer violations of the standards being reported over the past few years basically because of implementation of the Albuquerque/Bernalillo Air Pollution Control Program.[10]

2.4 Geology: Surface and Subsurface Features

SNL/NM is located in the Rio Grande Rift Valley of the Basin and Range physiographic province. The Rio Grande Rift is a structural feature that trends north-south from southern Colorado to El Paso, Texas.[11] The SNL/NM area is situated on the East Mesa in the east-central portion of the Albuquerque-Belen basin segment of the rift (Illustration 2.4-1). The basin is bounded on the east by the fault-block Sandia and Manzano Mountains, which consist of Precambrian granites, schist, gneisses, quartzite, and metavolcanics; on the west by the Lucero uplift and Puerco plateau; on the north by the Nacimiento uplift; and on the south by the Socorro Channel.

Large-scale faulting, deepening of the basin and tilting of the mountains in the late Miocene period have resulted in a differential vertical movement of 6,000 to 7,000 meters on the eastern basin border.[12] Both concurrent with and subsequent to the structural changes, the basin began to fill due to a complex mixture of eolian, channel, debris flow, levee, and flood plain-type mechanisms[13] resulting in a complex sequence of gravel, sand, silt, clay, and caliche deposits known as the Santa Fe Formation. The basin, which consists primarily of Tertiary and Quaternary deposits, is estimated to be 1,200 to 1,500 meters thick (Illustration 2.4-2).

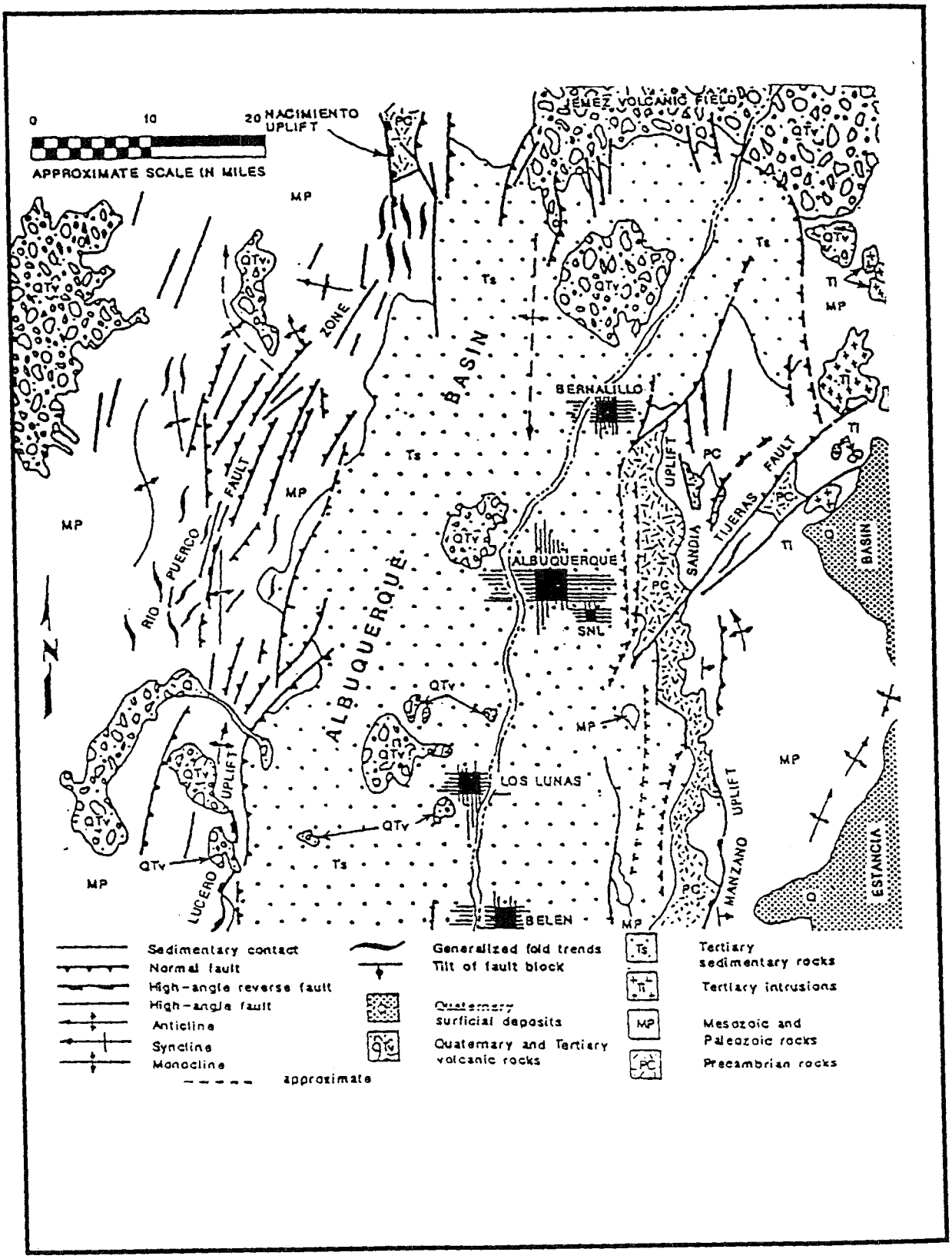


Illustration 2.4-1 Tectonic Map of the Middle Rio Grande Depression

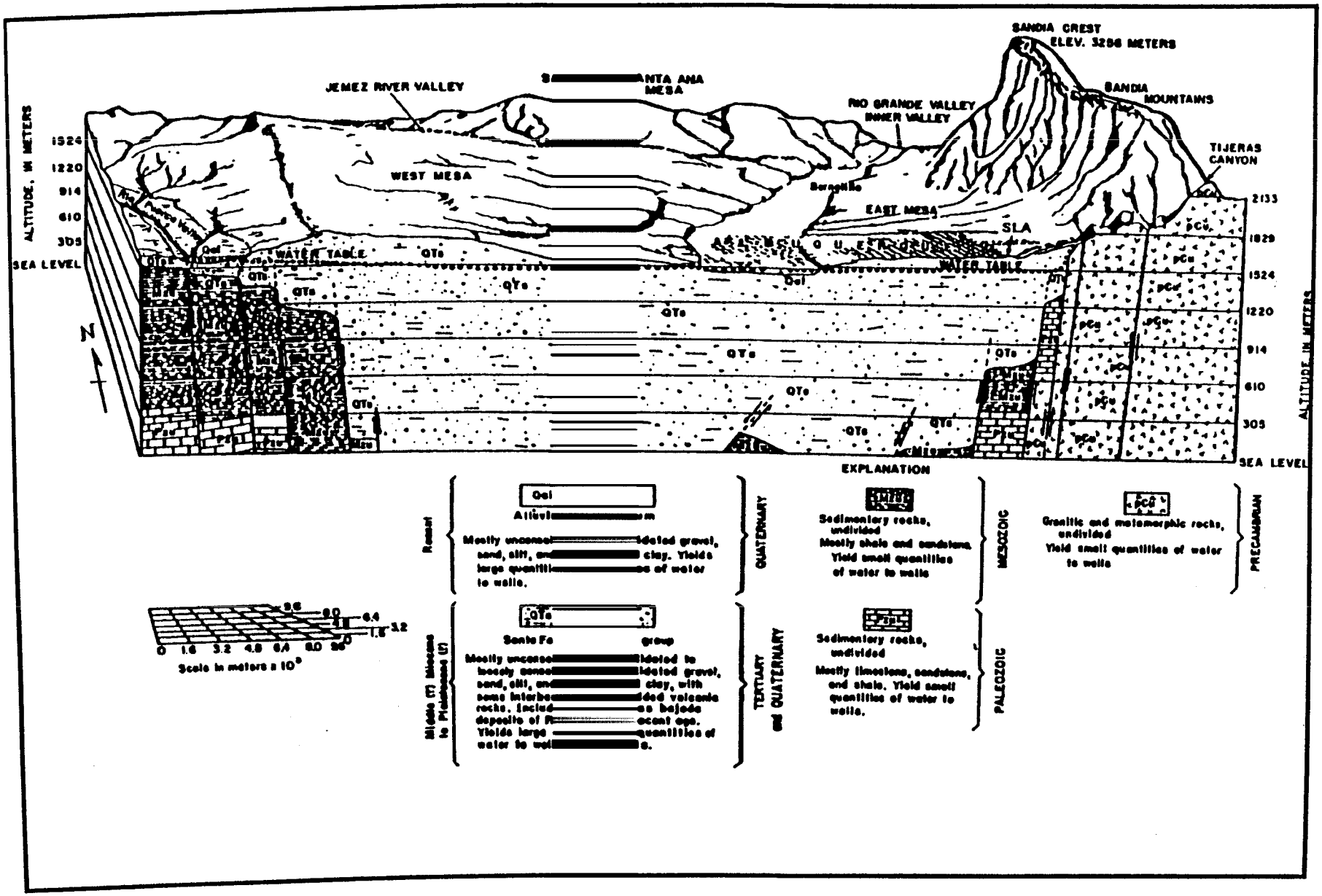


Illustration 2.4-2 The Basin, SNL/NM

The East Mesa is characterized by alluvial and colluvial deposits formed due to runoff from the mountains onto alluvial fans or stream channels. The soils are the Embudo gravel, fine, sandy loam and the Wink fine, sandy loam, both of which are part of the Maurez-Wink Association.[14] The Embudo soils are deep, moderately alkaline, well-drained soils that formed in alluvium derived from decomposed, course-grained, granitic rocks on old alluvial fans.[15] The Wink soils are deep, calcareous, and moderately alkaline, well-drained soils that formed in old, unconsolidated alluvium modified by wind.[16] Runoff from both these soils is medium with moderate water erosion hazard and the shrink-swell potential for both is low.[17]

The Rio Grande Rift between Albuquerque and Socorro is the most seismically active area in New Mexico. Seismic records date back to 1849, when the first reported earthquake occurred in Socorro; however, complete instrumental records are available only after 1962.[18] Instrumental data since 1961 indicate a maximum probable local magnitude shock (M_L) within a 100-year period of 4.2 to 4.9 on the Richter scale.[19] SNL/NM seismic activity research is being conducted as mandated by DOE Order 5480.28, Natural Phenomena Hazards Mitigation.[20]

The SNL/NM area is located in Seismic Risk Zone 2B (Illustration 2.4-3) in which moderate damage from earthquakes (corresponding to Intensity VII of the Modified Mercalli Intensity Scale of 1931) may be expected to occur.

The largest recorded earthquakes in the Albuquerque-Socorro area have been measured at 4.7 on the Richter scale. An earthquake of this magnitude occurred on January 4, 1971, with the epicenter in the Albuquerque area. Minor damage to buildings was reported by the University of Albuquerque (now St. Pius High School); however, no damage to SNL/NM buildings was reported.

Two other earthquakes with magnitudes of approximately 4.7 on the Richter scale occurred on November 28, 1970, and January 4, 1990, near the town of Bernardo, New Mexico, 104 km south of Albuquerque. Damage to the Bernardo area was the only damage reported.

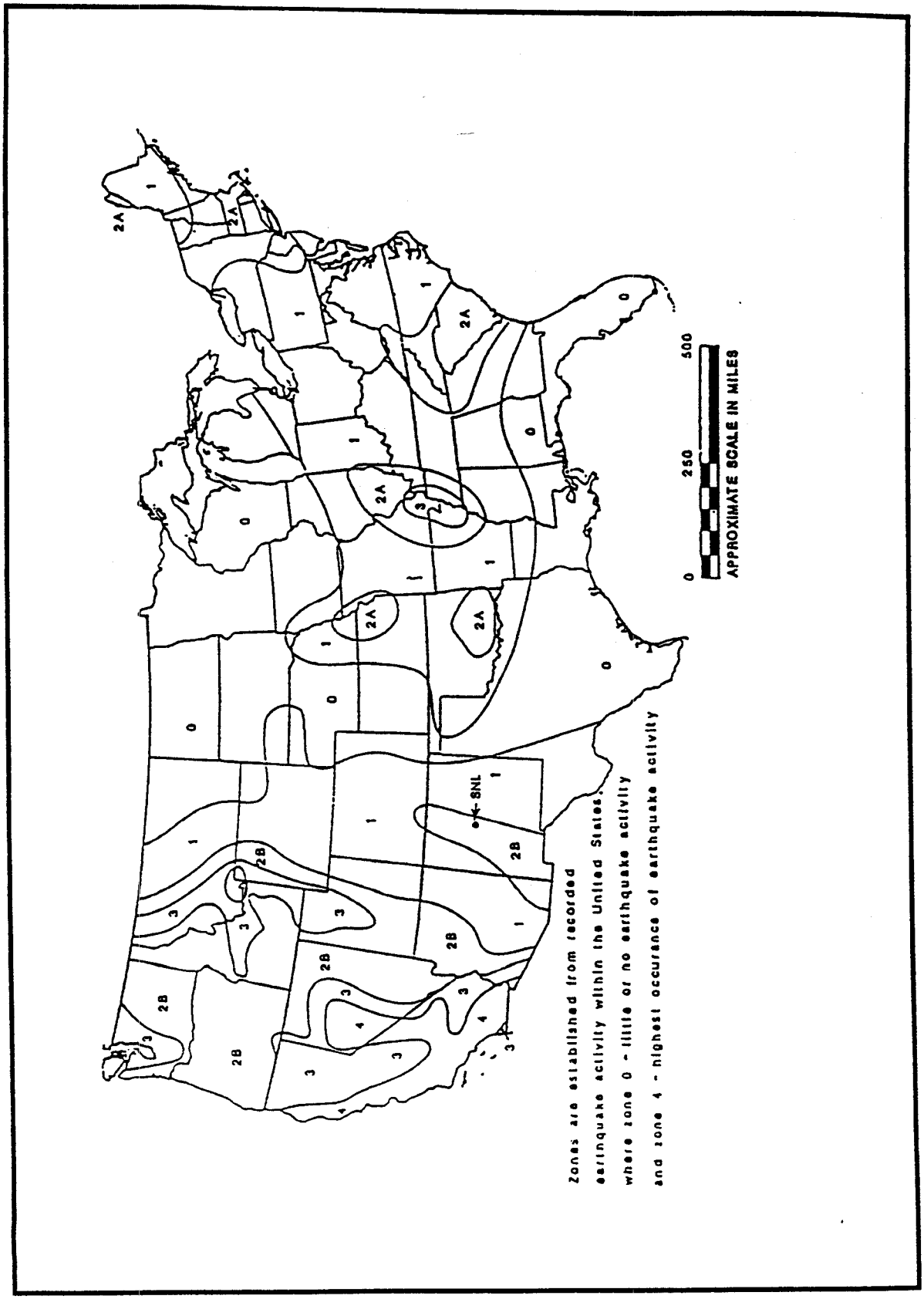
The fault zones along the eastern and western sides of the Albuquerque-Belen Basin were active in Miocene times and appear to have become stable since the mid-Pleistocene. Present seismic activity shows little correlation with the Albuquerque area fault zones, but is concentrated more with the mountains west of Socorro, 120 km south of KAFB.

Numerous small volcanic centers occur along a line paralleling the axis of the Albuquerque basin to the west of the metropolitan area. The volcanoes include five small cones and 13 nubbins, the largest of which protrude about 54 meters above the ground surface. At least eight flows (andesite and basalt) occurred in the volcanic field, which was active only for a short period approximately 190,000 years ago.

2.5 Water Resources

2.5.1 Surface Water

The East Mesa has a generally west-southwestward ground surface slope ranging from about 47 meters per kilometer (m/km) near the mountains to 3.8 m/km near the river. The distance from the foot of the mountains to the river varies from 4.8 km in the northern part of the mesa to 14.5 km in the southern part of the mesa.[21]



Ilustration 2.4-3 Seismic Risk Zone 2B, SNL/NM

Tijeras Arroyo, the major drainage of the East Mesa area, originates in the mountains and joins the Rio Grande at approximately 16 km south of Albuquerque, cutting across the eastern part of KAFB. In addition, numerous small drainages emerge from the mountains onto the mesa. In general, very little of this surface water reaches the Rio Grande[22] because most surface water runoff enters the permeable deposits of the Quaternary-Tertiary alluvium or is evaporated or transpired.

During heavy precipitation, the elevated interfluvial regions drain by sheet flow into small gullies and rivulets. This water is carried by natural or artificial flow paths into Tijeras Arroyo and eventually reaches the Rio Grande. Occasional flooding is likely within these gullies and arroyos. The Army Corps of Engineers has estimated that a 100-year flood will reach a crest of approximately 1,572 meters. The 24 meter walls of the Tijeras Arroyo are adequate to protect SNL/NM against flooding.

2.5.2 Subsurface Water

The major subsurface reservoir beneath the Albuquerque area (including SNL/NM) is composed of basin fill material of the Rio Grande (for deposits and alluvial material of Quaternary and Tertiary age) with a depth to bedrock of nearly 1.6 km throughout most of the basin (Illustration 2.4-2). The alluvial aquifer is bounded on the west by the Lucero uplift and on the east by the Sandia-Manzano Mountains.[23]

Groundwater in the alluvial aquifer generally occurs under unconfined conditions and flows in a southward direction under an overall gradient of approximately 2 m/km. The transmissivity of the alluvial aquifer is estimated to be 2,480 m^2 per day , and storativity (quantity of water that the aquifer will release from or the quantity that will be taken into storage per unit surface area of the aquifer per unit of head) is approximately 0.2. The groundwater flow velocity is approximately 6 meters per year.[24] The water table beneath SNL/NM on the East Mesa is approximately 150 meters beneath the surface, and groundwater generally flows in a southwestern direction towards the axis of the Rio Grande alluvial basin.

The alluvial aquifer is recharged principally by the Rio Grande. The aquifer also receives recharge at the base of the mountains where small canyons open onto alluvial fans and the alluvium is relatively coarse. Relatively little water percolates into the aquifer through the unsaturated zone, as most runoff from precipitation ultimately flows into drainages and into the Rio Grande, or is lost through evapotranspiration.

The greatest water level changes from 1961 to 1978 in the Albuquerque area were recorded on the east side of the Rio Grande. In the future, water levels will continue to decline on both the east and west sides of Albuquerque due to increased population. Total decline of the water table by the year 2000 will probably not exceed 37 meters of fresh-water saturation in the aquifer beneath the Albuquerque area.[25]

2.6 Flora and Fauna

The vegetation in this area is typical of an arid grassland. While more than 50 grasses may be found within this grassland association and the surrounding area, only a small number of species are abundant. The homogeneous nature of the vegetation does not support a high diversity of wildlife. Small mammals, reptiles, and birds are the most abundant species found. No species of federally listed endangered or threatened plants or animals have been observed at SNL/NM. The New Mexico Energy, Minerals and Resources Department[26] lists two state endangered species of cacti as potentially occurring in the area—the grama grass cactus and Wright's fish-hook cactus. The New Mexico Game and Fish

Department's *Handbook of Species Endangered in New Mexico* lists four animal species that may occur in Bernalillo County. However, these species are not expected to reside at SNL/NM because of specific habitat requirements.

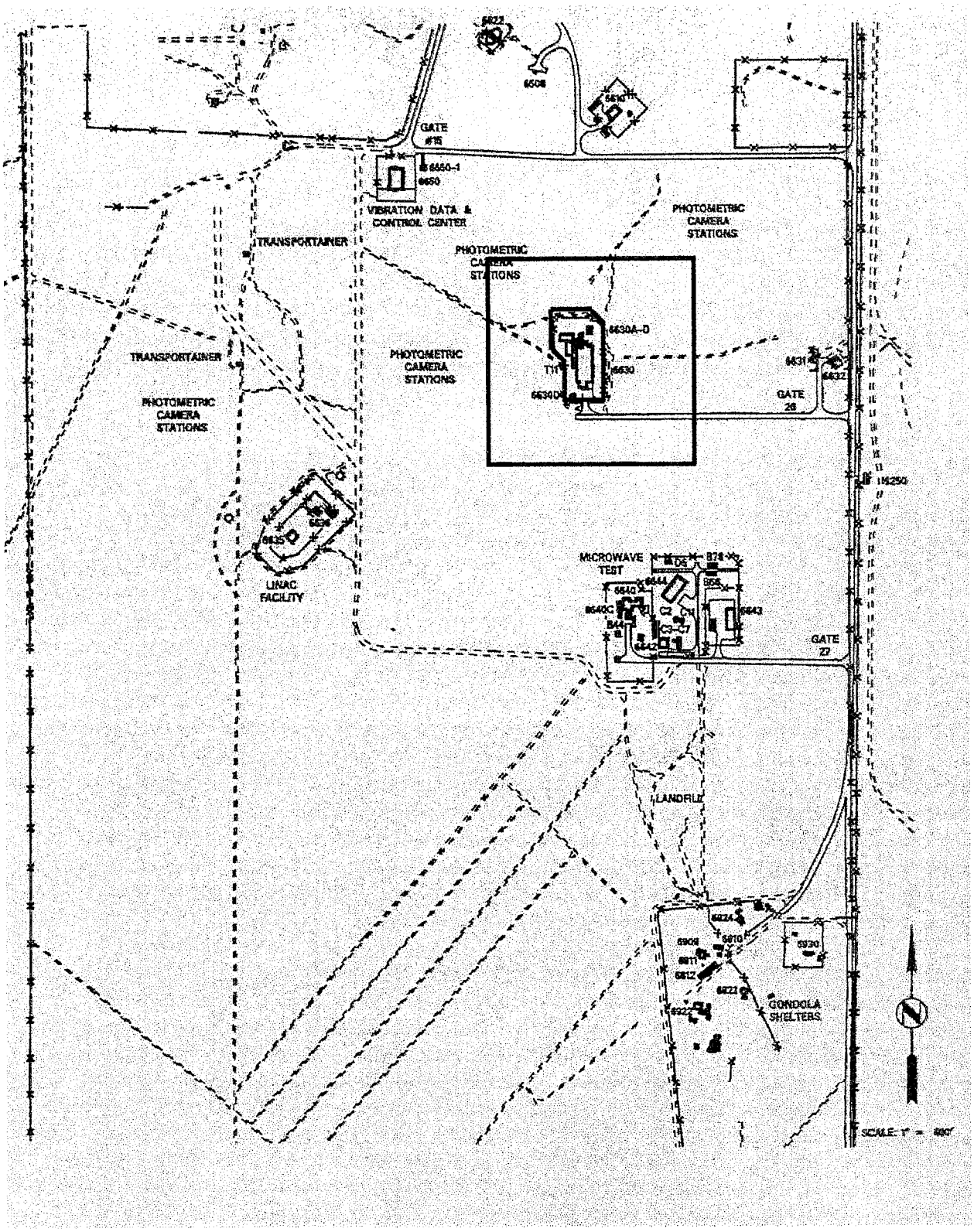
2.7 Demography

SNL/NM is on KAFB, which is located in Bernalillo County, New Mexico. The population of Bernalillo County in 1990 was 480,577.[27] KAFB is bordered on the north and west by densely populated residential areas of the City of Albuquerque. To the east of KAFB is the Four Hills residential area of Albuquerque. Albuquerque had a population of 384,736 in 1990.[28] To the south of KAFB is the Isleta Indian Reservation, which had a population of 2,915 in 1990,[29] and Valencia County. Valencia County is a rural and sparsely populated area. The most recent population figure for Valencia County is 45,235.[30] KAFB itself houses up to 7,830 residents in barracks and detached or semi-detached family houses. As of 1990, the residential population of KAFB was 5,761. The total estimated population within a 80 km radius of SNL/NM is 632,500.

2.8 Description of Building 6630 and Boundaries

Building 6630 is located in Technical Area-III (TA-III), approximately 1,630 meters south of the TA-III gate, and approximately 330 meters west of the TA-III fence. The facility is a one-story building with a high-bay and attached temporary office buildings. The facility also contains several outside, detached storage buildings. The building is constructed with a concrete slab foundation with cement masonry unit and corrugated metal walls. The roof is constructed of metal truss, bar joints and metal decking with a built-up roof. The office space interior is finished with vinyl floor tile or carpet, wallboard interior walls and suspended ceilings. The vacuum arc remelting facility in the northeast corner of Building 6630 is surrounded on three sides by a 3.66 meter high reinforced concrete blast barrier capable of withstanding a 5 pounds per square inch (psi) pressure pulse[31]. The fourth (exterior) wall is designed to disintegrate at pressures greater than 0.14 psi. Hence, in the unlikely event that an explosion would occur, the force of the explosion would be directed upward and all debris would be directed upward and outward. The area exterior to the frangible wall is surrounded by a security fence at a distance of 15.25 meters from the building, and the area exterior to the security fence is open desert for approximately 400 meters. Recently, a 548.13 square meter addition was added to Building 6630 to house the Investment Casting Facility. The addition transferred the chemical inventory from 878, Rooms Y900 and Y910 to Building 6630. No hazards exceeding the screening criteria were transferred to Building 6630.

The Building 6630 facility boundary is defined as 30 meters, because the building walls constitute the only physical barrier that could separate the general public from the hazards associated with the laboratories within Building 6630. Coincidentally, a distance of 30 meters is employed to identify all facility boundaries in all SNL facility specific HAD's in consonance with emergency planning practices and is described in Section 3.1.1.1, Chemical Hazard Dispersion Modeling. A 100 meter site boundary was identified because Building 6630 is not located in a densely populated area and would not include any buildings not associated with the processes in Building 6630. This is in accordance with the Emergency Management Guide (EMG) which states that areas subject to access by the general public must be considered offsite unless it is assured that those areas can be evacuated and access control can be established within one hour with current staffing resources. The 30 meter facility boundary and 100 meter site boundary are also utilized in Section 6.0 for determining Building 6630's emergency classifications. Building 6630, its facility and site boundary, and nearby facilities are shown in Illustration 2.8-1.



Note: The facility boundary is denoted by the red line. The site boundary is denoted by the blue line.

Illustration 2.8-1
6630 Facility/Site Boundary

2.9 Facility Mission

Building 6630, the Liquid Metal Processing Laboratory, serves as a research and development laboratory. Office space is located in temporary buildings T11 and T49, which are located on the west side of Building 6630, within the site boundary of Building 6630 . The activities in Building 6630 include melting and casting research for various metals.

2.10 Description of Building 6630 Laboratories, Processes and Operations

The following section provides a list of the rooms that contain a hazard source and the organizations that own the process in the respective room. This section also provides a description of the processes and operations that take place within each laboratory. The information was taken from each respective Preliminary Hazards Assessment (PHA) for the facilities located in Building 6630. Building 6630's floor plans (evacuation routes and room locations) are found in Illustration 2.10-1 and 2.10-2.

2.10.1 Vacuum Arc Remelting Furnace

The Vacuum Arc Remelting Furnace, located in the northeast corner of Building 6630, is occupied by Sandia National Laboratories Liquid Metal Processing Department and contains one chemical of concern. The furnace is used for vacuum arc remelting, which is a secondary refining process used for the production of segregation sensitive metal alloys. Activities in the laboratory include the loading of cylindrically shaped electrodes into the furnace body, which consists primarily of a long, cylindrically shaped, water cooled copper crucible. The furnace is then closed and evacuated to a pressure of approximately 1 Pascal. An electrical current is supplied to the furnace and an electrical arc is struck between the electrode and some starting material that has been placed in the bottom of the furnace for this purpose. The arc heats the electrode tip and the start material until it becomes molten. Material drips from the electrode tip into the molten pool below and the electrode is gradually consumed while the pool level rises. During the melt a variety of diagnostics are employed to monitor and analyze furnace voltage, current, and arc properties. The chemical inventory for the Vacuum Arc Remelting Facility can be found in Appendix A.

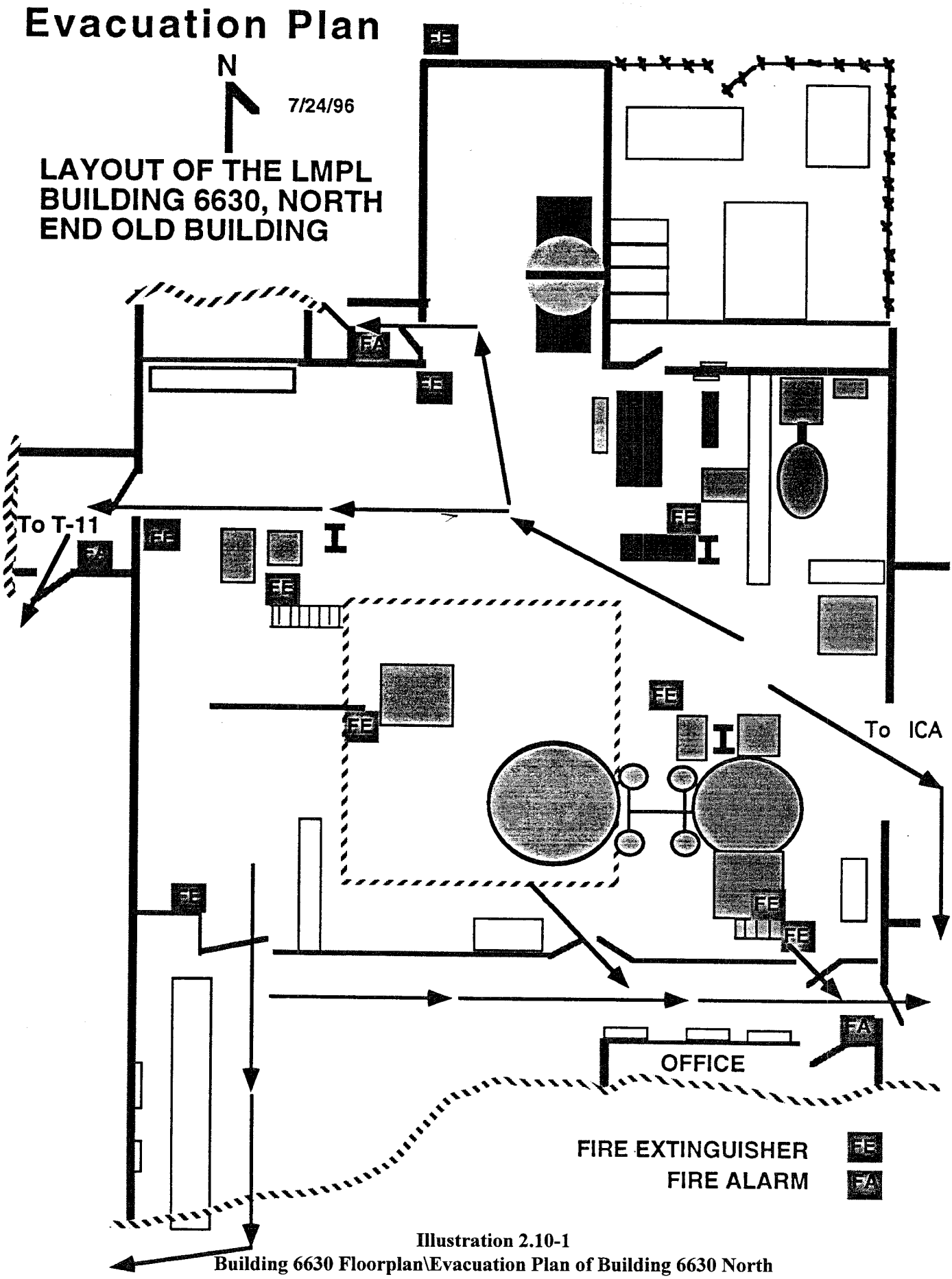


Illustration 2.10-1
Building 6630 Floorplan\Evacuation Plan of Building 6630 North

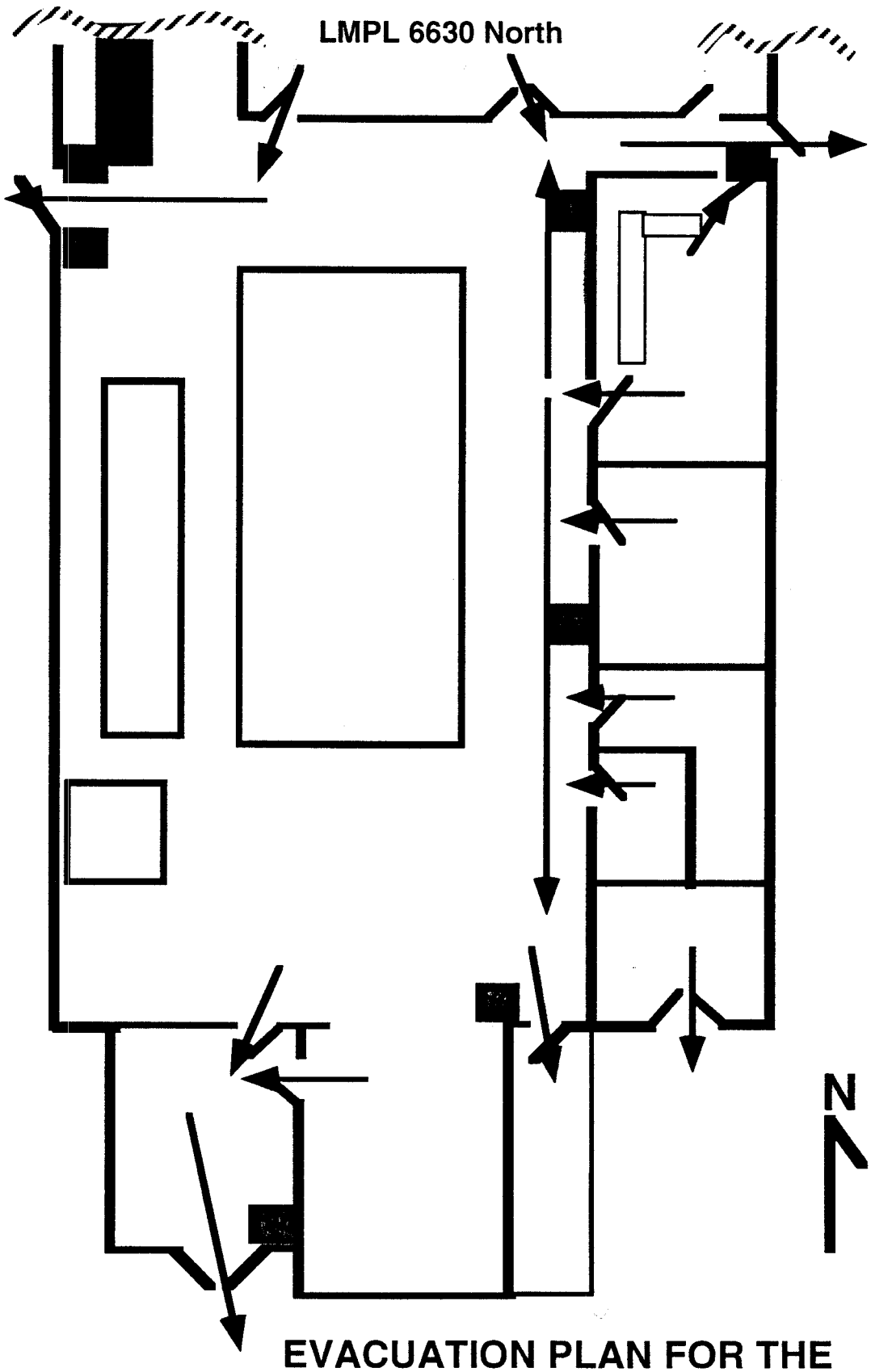


Illustration 2.10-2
Building 6630 Floorplan\Evacuation Plan of Building 6630 South

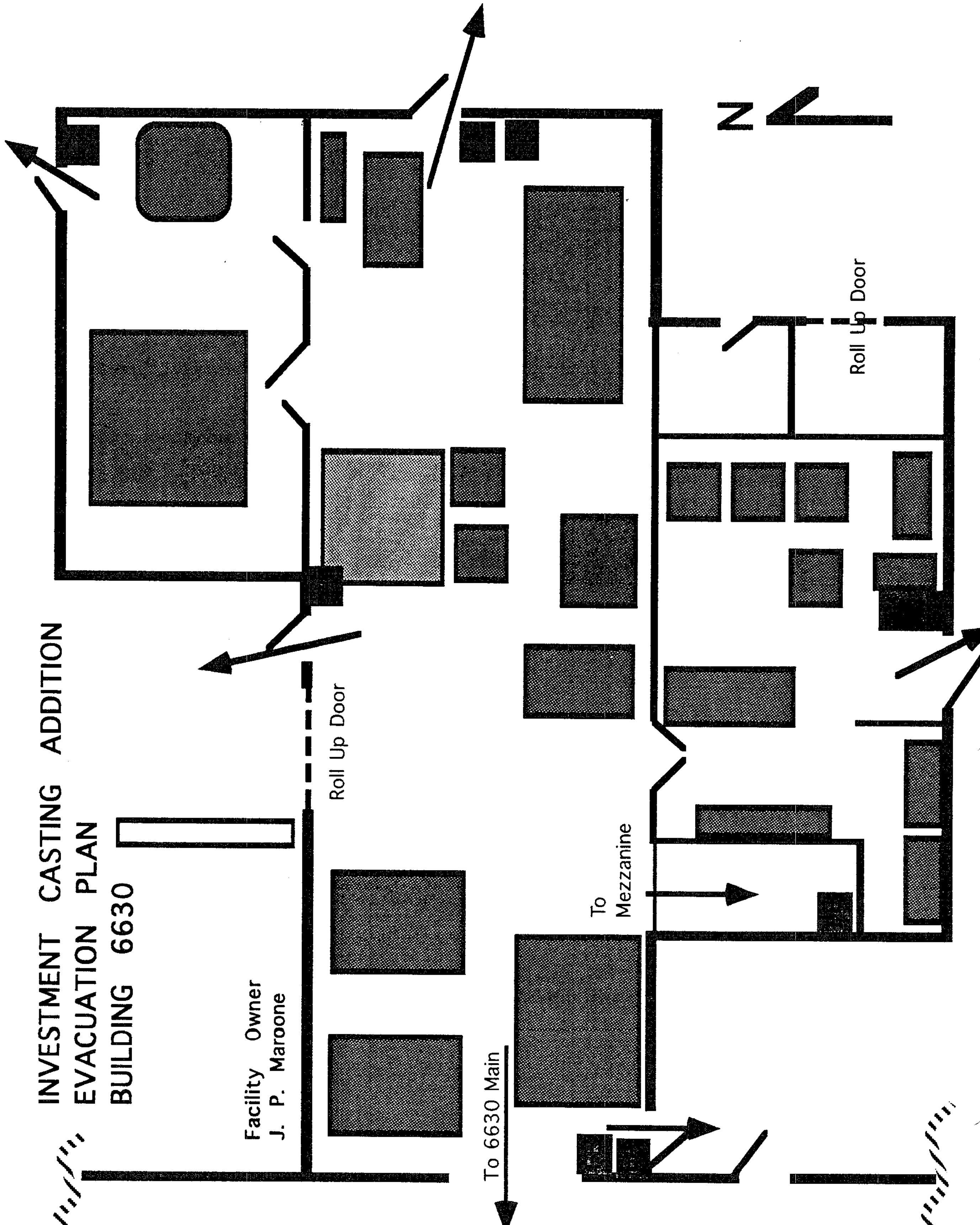


Illustration 2.10-3
Building 6630 Floorplan\Evacuation Plan of Building 6630 Investment Casting Addition

BUILDING 6630 COMPOUND

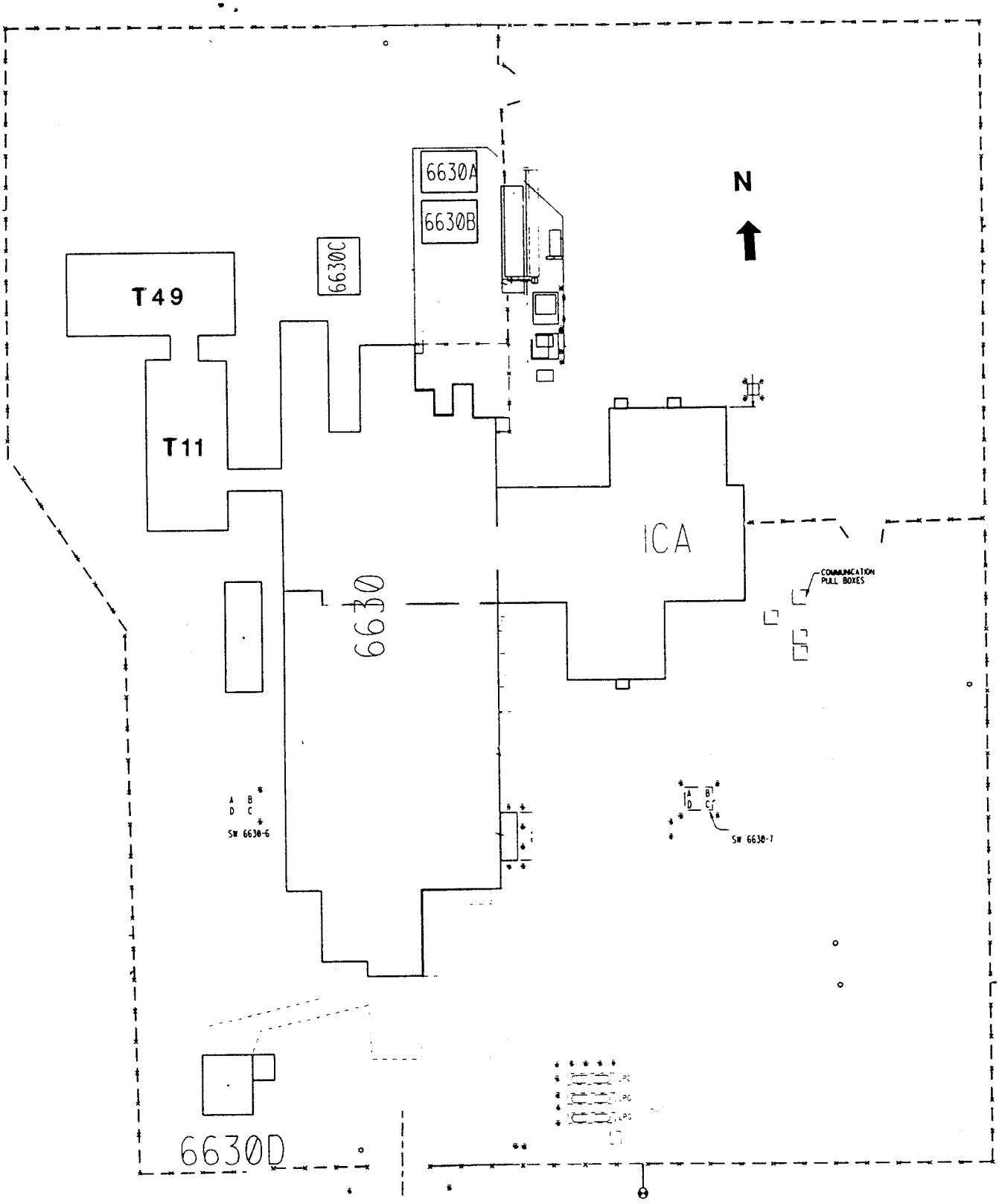


Illustration 2.10-4
Building 6630 Compound

3.0 IDENTIFICATION AND SCREENING OF HAZARDS

This section outlines the processes used to identify both onsite and offsite hazards significant enough to warrant consideration in the SNL/NM emergency management program for Building 6630 and to screen out those hazards that pose minimal risk to the health and safety of the onsite worker and the general public. Those hazards identified by the screening process that pose a significant risk are further evaluated in Section 4.0.

3.1 Identification and Screening of Onsite Hazards

For the purpose of emergency planning, onsite hazards of primary concern are those hazardous materials that if released to the environment may:

- immediately threaten those who are in close proximity to the release,
- have the potential for dispersal beyond the immediate vicinity in quantities which threaten the health and safety of onsite personnel or the public in collocated facilities and/or offsite,
- and have a rate of transport and dispersion sufficient to require time-urgent emergency response to implement protective actions.

The process of identifying the onsite hazards at Building 6630 consisted of the following steps: (a) reviewing the most current PHAs and safety assessments for Building 6630 specific information (b) reviewing the ChemMaster chemical inventory to determine the maximum quantities, and (c) conducting walkthroughs of the facility to verify that the ChemMaster inventory was complete and accurate.

The following primary sources of information were used to complete the hazard identification and screening process. Based on this information, a comprehensive list of hazardous materials was compiled for Building 6630.

- Emergency Sector Plans
- Preliminary Hazard Assessments (PHAs)
- Standard Operating Procedures (SOPs)
- ChemMaster Chemical Inventory
- Safety Assessments
- Material Safety Data Sheets (MSDSs)

3.1.1 Screening Criteria

The Emergency Management Guide (EMG) for Hazards Assessments states, in part, "... screening quantities or thresholds should be used to eliminate the need to analyze insignificant hazards."[32] Using this guidance from the EMG and other applicable documents, the following screening criteria were developed and utilized to screen chemical and radiological hazards.

3.1.1.1 Chemical Hazards

Standard Industrial Hazard (SIH)

In accordance with 40 CFR, Part 355.20, "Any substance used for personal, family, or household purposes, or is present in the same form and concentration as a product packaged for distribution and use

by the general public" is not considered a hazardous chemical.[33] Therefore, for the purpose of hazards assessments, such chemicals can be eliminated from further evaluation.

Quantity of Material

Chemicals in quantities less than 454 grams (g) are eliminated from further evaluation. This was established based upon 40 CFR Part 302, the Hazardous Substances and Reportable Quantities[34] and 40 CFR Part 355, Appendix A, the Extremely Hazardous Substances and Threshold Planning Quantities[35] in which no chemical had a quantity listed less than 454 g.

Toxicity of Material

For those chemicals exceeding 454 g, the MSDS and/or the Hazardous Chemical Desk Reference[36] are reviewed to determine if a chemical is hazardous due to its toxicity. Occupational exposure limits are reviewed to determine the toxicity. Those chemicals determined to be non-toxic are eliminated from further evaluation.

Dispersibility

A chemical is eliminated from further evaluation if it is determined to be non-dispersible. In order for the chemical to be non-dispersible, it must meet at least one of the following criteria:

- have a boiling point of greater than 100° C,
- be a powder of greater than 10 microns, or
- cannot conceivably be involved in a high energy event such as a fire or explosion.

Flammables and Explosives

For flammable materials (flashpoint of less than 60 ° C) in quantities greater than 454 kilograms further characterization will be performed to determine consequences of initiation. Also, Division 1.1 (Class A) explosives as designated by 49 CFR 172, Table 172.1 will be kept for further characterization.

Dispersion Modeling

Dispersion modeling allows chemicals to be analyzed to determine toxicity levels at various distances after a postulated release. This hazards assessment is primarily concerned with Emergency Response Planning Guidelines (ERPGs) published by the American Industrial Hygiene Association (AIHA).[37] The ERPG levels in ascending order of severity are ERPG-1, ERPG-2, and ERPG-3. The level of concern used in the screening criteria is an ERPG-1. The ERPGs are discussed in detail in Section 8.1 of this document.

A chemical is eliminated from further evaluation if it does not exceed an ERPG-1 level at 30 meters. The distance of 30 meters was selected because it represents the minimum facility boundary at SNL/NM. The minimum facility boundary of 30 meters was determined in accordance with the Emergency Management Guide which states that a 200 meter radius may be utilized as the facility boundary if this area does not encompass a significant number of other site workers and does not include areas routinely accessible to the general public. In such a case, a smaller facility boundary is appropriate.[38] Because Building 6630 is not located in a densely populated area, a conservative 30 meter facility boundary and a 100 meter site boundary was utilized in dispersion modeling to determine toxicity levels at a definitive

distance. An ERPG-1 at 30 meters or greater would constitute a minimum of an Alert emergency classification. Emergency classifications are described in Section 6.2.2 of this document.

Dispersion modeling is performed utilizing the Areal Locations of Hazardous Atmospheres (ALOHA) model. ALOHA allows two types of dispersions: heavy gas and gaussian. If unsure which dispersion type should be used, ALOHA gives the option to let the model decide. The infiltration building parameter that should be used in the screening process is 60 air changes per hour. In addition, "worst case" meteorological conditions should be employed (i.e., wind speed of 1 m/s, 10% cloud cover, F stability, 50% humidity, and 20° C).

3.1.1.2 Radiological Hazards

For radioactive materials, the screening criteria is based on 10 CFR, Part 30.72, Schedule C[39] which lists radioactive materials that require consideration for emergency planning. Any radioactive materials that exceed the quantity in curies in 10 CFR, Part 30.72, Schedule C, are kept for further evaluation and characterization. All other radioactive materials are considered insignificant hazards and are eliminated from further evaluation.

3.2 Identification and Evaluation of Offsite Hazards

The objective of the hazards assessment is to determine the type and extent of planning and preparedness that is appropriate for each facility and site. Hazards originating outside the DOE facility and site that could impact the health and safety of onsite personnel or other DOE interests are identified and examined. Offsite facilities, airways, highways, railroads, and utility transportation arteries (i.e. pipelines) are considered as possible locations of hazardous material accidents.

The Local Emergency Planning Committee (LEPC) for the City of Albuquerque, on which Sandia is represented, is headquartered in the Albuquerque Fire Department, with an assistant Fire Chief being the chairman of the committee. The assistant Fire Chief was consulted to provide assistance in identifying nearby facilities in the city of Albuquerque that have hazardous material inventories that could potentially impact the Sandia Albuquerque site. Railroads, highways, and other transportation arteries near the facility or site were considered as possible locations of hazardous material transportation accidents. The effects on the facility of hazardous material events originating offsite were estimated and used as the basis for determining whether specific arrangements should be made with offsite authorities for notification of releases and joint response.

3.2.1 Offsite Facilities

The following offsite facility with a hazardous materials inventory large enough and within a reasonable distance of SNL/NM that could have a negative impact on the operation of SNL/NM has been identified.

- The City of Albuquerque water treatment plant is located approximately 10 km from the SNL/NM Site Boundary. This facility has the capacity to store up to 45,359 kilograms (kg) of liquid chlorine in two 22,679 kg capacity tanks.[40] Chlorine is used to treat the municipal water system for biological contaminants prior to distribution. In the event of a significant airborne chlorine release to the environment, the LEPC would contact the SNL/NM EOC. The EOC would then implement protective actions, as needed.

- Additional facilities are currently being researched as part of the City of Albuquerque's Emergency Preparedness program. Several individuals from SNL/NM Emergency Planning and Risk Management and NEPA Department are members of the LEPC. The identification of offsite facilities that could potentially impact SNL/NM is a continuous process.

3.2.2 Airways

Due to the close proximity of the Albuquerque International Airport to SNL/NM, an airplane crash scenario is postulated and considered an offsite hazard. Extensive research concerning an airplane crash at SNL/NM was performed and the results of this analysis are summarized in the text and tables included in Sections 3.2.2.[41]

A significant fraction of the more than 225,000 annual operations at the airport could pass over SNL/NM facilities. SNL/NM is also located about 25 km from Coronado Airport. However, since the general aviation aircraft using this facility would, in general, avoid the Albuquerque International Airport traffic area and based on the relatively long distance to Coronado Airport and the altitude that such aircraft will have if they happen to pass over Sandia, such aircraft are not a significant factor in determining the crash probability. Therefore, they are not considered to pose a significant risk to SNL/NM facilities.

3.2.2.1 Event Frequency Estimation

Several low-and high-altitude airways pass over or in the vicinity of SNL/NM. Because of nearby high terrain, the minimum en route altitudes of these airways are relatively high, about 1,400 meters or more above ground level. Although the frequency of flights using these airways is unknown, the crash frequency resulting from on-airways (or in-flight) through traffic would not be significant relative to the crash probability resulting from landings and takeoffs at the Albuquerque International Airport. The contribution of in-flight or airways traffic to the crash probability is therefore ignored.

The Albuquerque International Airport is utilized by commercial air carriers, the military, and general aviation aircraft. The carrier aircraft are jet transports, of which the largest currently in use at the airport is the Lockheed 1011. The military aircraft are primarily jet fighters but also include other aircraft ranging from small helicopters to the Lockheed C-5. General aviation aircraft include light single and twin engine airplanes. In this analysis, three types of aircraft are considered: air carrier jets typified by jet transports of the Boeing 737 through the DC-8 and 9; military aircraft typified by the A7; and air taxi (commuter) airlines and general aviation aircraft typified by light twin-engine aircraft.

Since only data on the total aircraft movement at the Albuquerque International Airport is available and because of the lack of specific data on the number of take-offs and landings, it will be assumed that the number of landings and takeoffs are the same.

Due to safety and noise abatement considerations, the preferred directions for takeoffs and landings is to the south, east, and west of the airport. If it is assumed that these directions are equally likely to be used for both landings and takeoffs, the east end of the East-West runway will have approximately 34% of the total aircraft movement. The movement of aircraft west of the East-West runway or south of the South-North runway are assumed not to contribute to the probability or number of crashes. In other words, the fraction of movements (landings and takeoffs) at the east end of the runway will be 0.34 for all types of aircraft. Table 3.2.2.1-1 presents aircraft movement data at Albuquerque International Airport for the calendar year 1990. These data were provided by the Albuquerque Airport Manager's Office.

Table 3.2.2.1-1
Total Aircraft Movement at Albuquerque International Airport (1990)

Aircraft Type	Operations
Air Carriers	70,108
Military	35,792
General Aviation/Air Taxi	119,991
Total	225,891

This movement has been steadily increasing each year. Therefore, to ensure conservatism in aircraft movement in the future, an average increase of 100% is assumed over the life of the facility (assuming on the average, a growth rate of 2.5% per year for an assumed facility life of 40 years). Thus, the total number of movements (landings or takeoffs) at the east end of the runway per year for each of the categories of aircraft is assumed to be

$$N_{carrier} = N_1 = 140{,}216$$
$$N_{military} = N_2 = 71{,}584$$
$$N_{general} = N_3 = 239{,}982,$$

for a total of 451,782 movements. The probability of a crash per aircraft movement (landing or takeoff), P_i, for all types of aircraft is given in Table 3.2.2.1-2.

Table 3.2.2.1-2
Crash Probability (P_i) per Aircraft Movement and Type of Aircraft

Movement	Air Carrier	Military	General Aviation
Landing	$2.3E^{-6}$	$3.1E^{-6}$	$2.3E^{-6}$
Takeoff	$6.0E^{-6}$	$1.6E^{-6}$	$6.0E^{-7}$

3.2.2.2 Airway Summary

In the unlikely event of an airplane crash, the SNL/NM, KAFB, and the City of Albuquerque emergency response teams would jointly respond. For the purpose of hazards assessments, the airplane crash scenario could serve as a possible initiating event which fails all mitigative barriers.

3.2.3 Highways

Two major transportation routes are proximal to the Sandia Albuquerque site. These are U.S. Interstate 40, approximately 4.0 km to the North, and U.S. Interstate 25, approximately 4.0 km to the West of the KAFB site boundary.

Truck accident statistics (1989-1990) from the Motor Carrier Division of the National Highway Safety Council indicate the average accident rate for medium to heavy vehicles (>4536 kg Gross Vehicle Weight) to be one accident per 3.5 million km.[42]

The accident rate may appear to be statistically quite low. However, because of the size of the transportation routes surrounding SNL/NM and the high volume of truck traffic on the roads, the potential for a vehicle accident involving hazardous materials is considered to be a credible scenario.

The New Mexico State Police maintains responsibility for response to a hazardous materials accident on local transportation routes. In compliance with the Federal Emergency Management Agency (FEMA) and the State FEMA and Local Exercise Requirements, the Albuquerque/Bernallillo LEPC conducts exercises relating to emergency response. The LEPC has conducted exercises relating to a hazardous materials accident to test the Emergency Response Plan. The Emergency Response Plan includes a provision for notifying SNL/NM in the event of an offsite transport transportation accident. SNL/NM can then take the necessary protective actions to ensure the safety and integrity of onsite personnel and their respective operations.

3.2.4 Railways

The Atchison Topeka and Santa Fe, which is a class 1 railroad, has a line that runs parallel to Interstate 25 through the city of Albuquerque, approximately 4.0 km from the western boundary of the DOE site on KAFB. The inventory of materials transported along this stretch of track for calendar year 1993 was provided by the Director of Environmental Quality and Hazardous Materials.[43] This data indicates that the majority of hazardous material is either flammable liquid or gas, or corrosive material.

Hazardous materials shipments comprise only 14% of the total car loads on the Sante Fe Railway.[44] The shipments are most likely mixed loads containing sizable amounts of nonhazardous material within the same trailer or container. Even though the percentage of hazardous materials is low, the potential for a railway accident remains a credible scenario.

In the event of a hazardous materials accident involving a rail car, a joint response between local responders, the State Police, and the railroad would be initiated. The railroad employs a team of security personnel to secure the hazmat spill site until arrangements can be made for cleanup and disposal. Federal law requires the notification of the LEPC in the event of a hazardous materials accident. Under the Emergency Response Plan, SNL/NM would then be notified. SNL/NM can then take the necessary protective actions to ensure the safety and integrity of onsite personnel and their respective operations.

3.2.5 Pipelines

Natural gas is distributed in Building 6630. Natural gas is considered an initiating event in Building 6630.

3.3 Building 6630 Chemical Hazards Summary

As a result of screening the hazards at Building 6630, one chemical in one location was kept for further evaluation. This evaluation is performed in Section 4.0, Hazard Characterization. The chemical kept for further evaluation is listed in Table 3.3-1.

Table 3.3-1
Building 6630 Hazardous Material Summary

Chemical	*Maximum Quantity*	*Location*
1. Carbon Monoxide	100 cubic feet	Vacuum Arc Remelting Furnace

3.4 Building 6630 Radiological Hazards Summary

The radiological hazards in Building 6630 fall below the screening criteria in 10 CFR, Part 30.72, Schedule C. Therefore, they are eliminated from further consideration.

3.5 Offsite Hazards Summary

SNL/NM provides representatives to the LEPC, and a strong working relationship with the offsite Emergency Response community has been established. Development of local plans is in progress, and the contemplation of both SNL/NM hazards to the city, and city hazards to SNL/NM are being incorporated in this planning development process. Therefore, no offsite hazards were considered for characterization or further evaluation.

4.0 HAZARD CHARACTERIZATION

The screening process described in the preceding section identified one chemical source that exceeded the screening criteria. This hazard is fully characterized (i.e. physical properties, storage, and use) in this section to support the development of accident scenarios and analysis of possible airborne releases. Engineered controls and/or safety systems designed to prevent or mitigate a hazardous material release are discussed. The administrative controls include approved SOPs for all handling and use of hazardous chemicals in Building 6630. These procedures include the use of protective equipment and protective clothing as well as the training requirements for all workers.

Chemicals are ordered at Building 6630 on an as-needed basis. Chemicals delivered to Building 6630 are placed in proper laboratory storage space.

ERPGs are listed in the characterization below[45] and are utilized in Section 6.0 to determine the consequences of the following hazards. For those chemicals in which no ERPG values were published, a conservative methodology was developed that expeditiously allows ERPG equivalents to be established for every chemical that has a Time Weighted Average (TWA) value. This methodology is described in detail in the Concentration Limit Hierarchy for Toxicological Accident Analysis,[46] and the ERPG equivalent calculations are depicted in Table 4.0-1. The ERPGs are discussed in detail in Section 6.0.

Table 4.0-1

ERPG Equivalent Calculations	
ERPG-1	TWA x 1.25
ERPG-2	TWA x 3.75
ERPG-3	TWA x 8.63

The following information was taken from the Hazardous Chemicals Desk Reference. [47]

4.1 Carbon Monoxide (CO), 100%

(CAS Number: 630-08-0, DOT: UN 1016/NA 9202)

Carbon monoxide is a colorless, odorless, poisonous, flammable gas. CO is mildly toxic by inhalation in humans but has caused many fatalities as it can cause asphyxiation by preventing hemoglobin from binding oxygen. It exhibits experimental teratogenic and reproductive effects and exhibits human systemic effects by inhalation. It can cause asphyxiation by preventing hemoglobin from binding oxygen. Chronic exposure effects can result at lower concentrations. After removal from exposure, the half life of elimination from the blood stream is one hour. Repeated exposure to low concentration of the gas, up to 100 ppm in air, is generally believed to cause no signs of poisoning or permanent damage. CO is a common air contaminant, as well as, a dangerous fire and explosion hazard when exposed to flame or heat. Violent or explosive reactions can occur on contact with various chemicals (e.g., bromine trifluoride). To fight a fire, stop the flow of gas.

Inventory

- 100 cubic feet is stored in the outside gas cylinder storage area at the southeast corner of the building

Properties

- Boiling point — -191.3° Celsius (C)
- Melting point — -207° C
- Density — 1.25 g/L @ 0° C
- Autoignition temperature — 608.9° C
- LEL — 12.5%
- UEL — 74.2%
- ERPG-1 for carbon monoxide (published) — 200 parts per million (ppm)
- ERPG-2 for carbon monoxide (published) — 350 ppm
- ERPG-3 for carbon monoxide (published) — 500 ppm

Conditions of Storage and Use

The carbon monoxide cylinder is stored in an outside cylinder storage area at the southeast corner of Building 6630. The cylinder is stored in a cylinder storage rack and is chained in place. The carbon monoxide is moved to the vacuum arc remelting area on a hand truck for use and is removed from the area after use. During use, the cylinder is mounted outside the concrete blast wall surrounding the vacuum arc remelting furnace.

5.0 EVENT SCENARIOS

The barriers that maintain control over each of the hazardous materials described in Section 4.0 have been analyzed, and the possible failure modes have been considered. The initiating events, barrier analyses, and release scenarios are described in the following section. Each scenario is identified by a release designation.

5.1 Chemical Event Scenarios

The chemical event scenarios described below are chemical spills and are classified as laboratory-type accidents. All scenarios consider the possibility of random bullets, as mandated in DOE Order 5480.16, Fire Arms Safety.[48]

The release options utilized in this hazard assessment are the puddle release and the direct release. If a chemical is in a gaseous state, a direct release option of ALOHA is employed. If a chemical is in liquid form, a puddle option of ALOHA is employed.

5.1.1 Carbon Monoxide (CO)

The release designations CO-1 and CO-2 depicted in Table 5.1 are representative of scenarios involving carbon monoxide.

Failure of the Primary Barrier

The carbon monoxide is stored in a DOT approved cylinder. Therefore, the cylinder is the primary barrier. The cylinder could fail as a result of: an accident during installation; an explosion; random bullets, or sabotage.

All methods of failure result in the release of the amount of carbon monoxide present in the cylinder at the time of the incident.

Effects of Other Barriers

No secondary barriers exist that would contain or mitigate a release. For emergency planning purposes, and in accordance with the EMG, the release is considered unmitigated, thus, no credit is given for additional barriers.

Table 5.1
Carbon Monoxide Scenarios

Scenario	Source Term Parameter	Meteorological Conditions	Release Designation
Accident during delivery or installation involving a 10 minute release of 100 cubic feet of carbon monoxide	Direct 10 cubic feet/minute	Worst Case	CO-1
		Average	CO-2

6.0 EVENT CONSEQUENCES

The consequences from the airborne release scenarios described in Section 5.0 are estimated to determine the area potentially affected, the need for personnel protective actions, and the time available to take those actions. This section describes computer codes, calculational techniques, input data used for dispersion modeling, and consequence criteria. The results of the dispersion modeling are summarized at the end of this section for each previously identified release designation. The dispersion model data sheets for each release designation are included in Appendix B.

6.1 Calculational Models and Methods

Event consequences are estimated using calculational models and methods that are most appropriate to the physical and atmospheric conditions of the site and the material released.

6.1.1 Calculational Models

The chemical model CAMEO and it's air dispersion model, ALOHA, were utilized for estimating the movement and dispersion of gases.[49] CAMEO was designed by the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Environmental Protection Agency (EPA) to help emergency planners, facility operators, and first responders plan for and safely handle, chemical accidents. The air dispersion model estimates pollutant concentrations downwind from the source of a release, taking into consideration the toxicological and physical characteristics of the release site, the atmospheric conditions, and the circumstances of the release.

6.1.2 Calculational Methods

The transport of hazardous materials in the atmosphere from Building 6630 to offsite locations during an accident is a significant concern. Several factors affect the downwind calculations. These factors include the source term (quantity of the material available for release and the size of the puddle, if applicable), release and evaporation rates, duration, mixture, transport, diffusion, deposition, and stability.

Six classes of atmospheric stability are used to indicate mixing in the atmosphere. These classes are referred to as the Pasquill-Gifford Stability Classes.

Pasquill-Gifford Stability Classes

A - Extremely unstable (bright, sunny days)
B - Moderately unstable
C - Slightly unstable (cloudy, low wind speed)
D - Neutral (heavy overcast, day or night)
E - Slightly stable (night, low winds)
F - Moderately stable (very low wind, night or just before dawn)

As shown in Table 5.1, two meteorological conditions were utilized: worst case and average. The meteorological conditions provided a range of accident scenarios for input into ALOHA. The worst case meteorological conditions are Pasquill-Gifford Stability Class F, a 1 m/s wind speed, and a 500 meter inversion.

The average Albuquerque meteorological conditions were obtained from the *Technical Guidance for Siting Criteria*,[50] by selecting data from four months (one from each season). This data provided a range of daily meteorological conditions. The calculations used to determine the average Albuquerque meteorological conditions can be found in the *1994 TA-V Hazards Assessment Document*.[51] The average meteorological conditions analysis resulted in the following conclusions: the average Albuquerque wind speed is 4 m/s and the average stability class is slightly unstable (Pasquill-Gifford Class C).

6.2 Consequence Thresholds

The consequence thresholds are based upon the Emergency Response Planning Guidelines (ERPGs) published by the American Industrial Hygiene Association (AIHA).[52]

6.2.1 ERPGs

The ERPG values are intended to provide estimates of concentration ranges above which one could reasonably anticipate adverse effects as a consequence of exposure to a specific substance. ERPG-1, ERPG-2, and ERPG-3 are defined below.

- The ERPG-1 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

- The ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

- The ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects. The ERPG-3 value represents the early severe health effects (ESHE) value.

  Note: For those chemicals in which no ERPG values were published, a methodology was developed that allows ERPG equivalents to be established for every chemical that has a TWA value (Table 4.0-1).

6.2.2 Application of ERPGs

The ERPGs are used to classify the operational emergency events. The three classes of operational emergencies in ascending order are: Alert, Site Area Emergency, and General Emergency. The ERPGs that result in the various levels of operational emergencies are described below.

- The ERPG-1 value is used as a screening criterion, as explained in Section 3.1.1.1, Dispersion Modeling. The ERPG-1 is also used to determine the low end of the emergency classification spectrum (i.e., Alert). For example, if an ERPG-1 is exceeded at 30 meters, the event would constitute a minimum of an Alert emergency classification.

- The ERPG-2 value is compared with the maximum toxicity concentration at the facility and site boundaries to determine the appropriate emergency class. If the ERPG-2 is exceeded within the site boundary, the event is considered a Site Area Emergency. If the ERPG-2 is exceeded beyond the site boundary, the event is considered a General Emergency.

- The ERPG-3 value is a consideration in defining the Emergency Planning Zone. The ERPG-3 value represents the Early Severe Health Effects (ESHE) value. The distance at which ESHE is reached is determined for each scenario.

6.3 Receptor Locations

Consequences of the hazardous material releases were quantitatively evaluated for various onsite and offsite receptor locations. The demarcation between the onsite and offsite receptors is the site boundary of Building 6630. The following distances are measured from Building 6630, and the carbon monoxide concentrations in ppm are based upon the worst case scenario CO-1.

Note: The concentrations associated with the receptor locations listed below should be compared to the carbon monoxide ERPG levels of concern:

ERPG-1 (published)	200 ppm
ERPG-2 (published)	350 ppm
ERPG-3 (published)	500 ppm

6.3.1 Onsite Receptors

The Building 6630 site boundary encompasses Building 6630, Building T-11, Building T-49 and its associated storage areas (Buildings 6630 A - D).

6.3.2 Offsite Receptors

The following offsite receptors include those facilities and areas outside the Building 6630 site boundary.

Table 6.3.2-1
Offsite Receptors

Offsite Receptor	Distance (m)	Concentration * (ppm)	Populations
Building 6631	~283	26.8	Transient
Building 6610	~347	18.2	Maximum of 10
Building 6636	~366	16.5	Transient
Building 6640	~274	28.6	6
Building 6650	~338	19.2	13

* Based upon the worst case scenario, release designation CO-1. As previously stated in Section 6.2.2, the ERPG-3 distance is used to determine the Emergency Planning Zone (EPZ) for the facility. CO-1 represents the furthest distance to ERPG-3, and therefore, will be considered the worst case scenario.

6.4 Summary of Consequences

As shown in Table 6.4-1, the greatest distances at which ERPG-2 and ERPG-3 are reached are 76 meters and 63 meters, respectively. The greatest Building 6630 emergency classification is found to be an Alert.

Table 6.4-1
Summary of Consequences for Building 6630

Release Designations	Maximum Concentration at Facility/Site Boundary at 30m (ppm)	Maximum Distance to		Possible/Probable Emergency Action Levels**	Emergency Event Classification
		ERPG-2 (meters)	ESHE (meters)		
CO-1	2,190	76	63	sight/auditory	Alert
CO-2	39.7	10	<10	sight/auditory	N/A

* There are not any quantifiable detection methods to confirm that an actual release has occurred in the scenarios described in Section 5.0, therefore, symptom-based EALs are not utilized in this hazards assessment. The above mentioned event-based EALs are stated in terms of the overall event descriptors as indicated by direct observation. The resulting event classifications are based on the consequences resulting from the releases of the total quantity of the material. [53]

7.0 THE EMERGENCY PLANNING ZONE

The results of the consequence analysis performed in section 6.0 were used to propose an Emergency Planning Zone (EPZ). An EPZ is a geographic area surrounding a specific DOE facility for which special planning and preparedness efforts are carried out to ensure that prompt and effective protective actions can be taken to reduce or minimize the impact to onsite personnel, public health and safety, and the environment in the event of an Operational Emergency.

7.1 The Minimum EPZ Radius

As can be seen from the data in Table 6.4-1, the highest facility emergency class is an alert, and the greatest distance at which a postulated facility event will produce consequences exceeding the Early Severe Health Effects (D_{ESHE}) threshold is 76 meters (Release Designation CO-1). In accordance with the EMG, a nominal EPZ that follows the physical and jurisdictional boundaries of SNL/NM was established. The EPZ is depicted in Illustration 7.1 on page 36.

7.1.1 Tests of Reasonableness

The EPZ meets the following five tests of reasonableness:

1. Are the maximum distances to PAG/ERPG-3 level impacts for most of the analyzed accident scenarios equal to or less than the EPZ selected?

   Yes. All of the ERPG-3 impacts are less than the EPZ.

2. Is the selected EPZ large enough to provide a credible basis for extending response activities outside the EPZ if conditions warrant?

   Yes. Lines of communication and decision processes involving KAFB, as well as city and county response agencies, have been established and practiced. In exercises, as well as actual events, the offsite agencies have demonstrated the flexibility to adapt and extend pre-planned response actions to different areas, depending upon the conditions of the particular event. This process is facilitated through the use of the Incident Command Structure.

3. Is the EPZ large enough to support an effective response at and near the scene of the emergency?

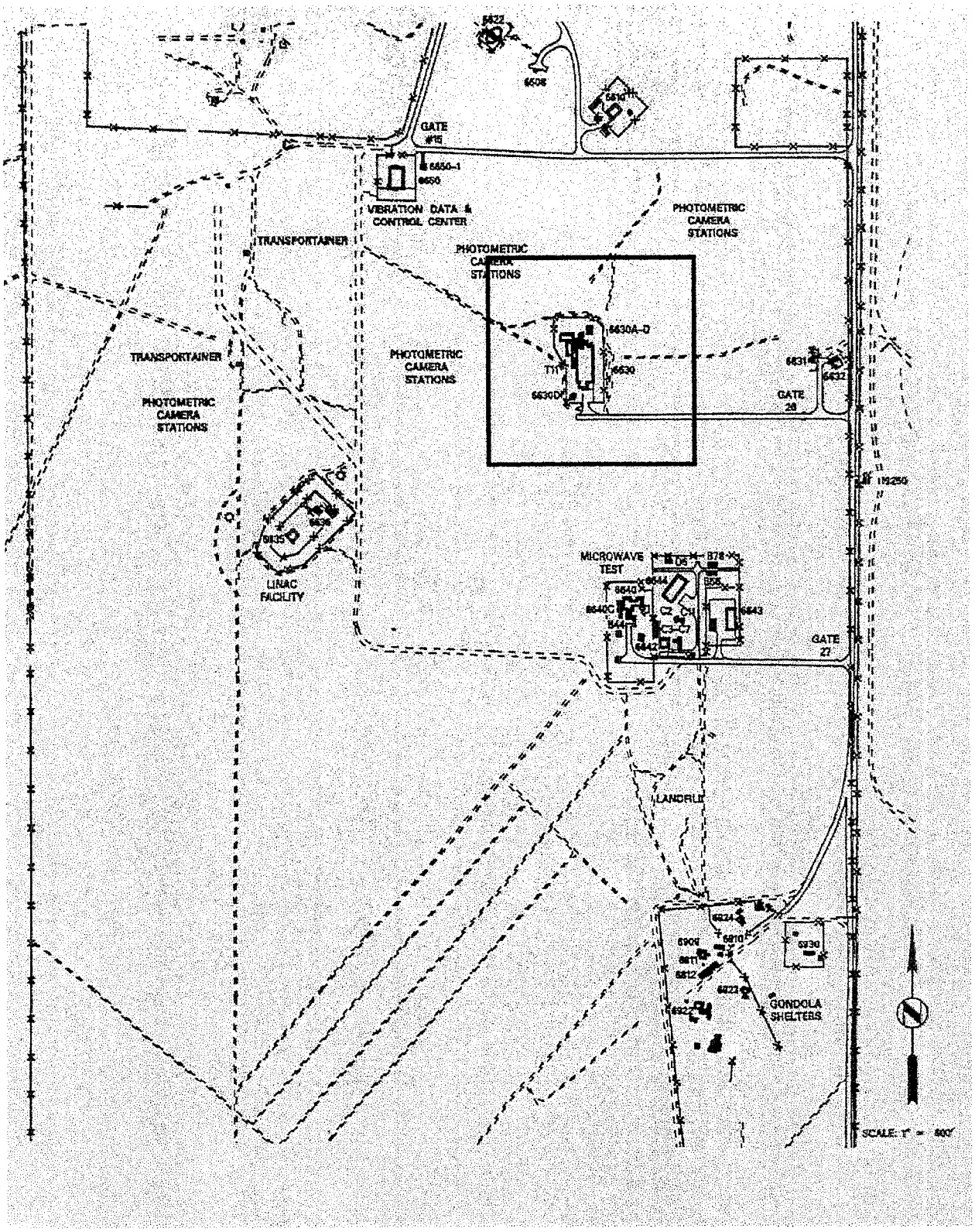
   Yes. The nominal EPZ encompasses Building 6630 and all routes leading to it.

4. Does the proposed EPZ conform to natural and jurisdictional boundaries where reasonable, and are other expectations and needs of the offsite agencies likely to be met by the selected EPZ?

   Yes. The EPZ conforms to jurisdictional boundaries and physical street boundaries. By utilizing streets as physical boundaries for portions of the EPZ, access within the EPZ can be adequately controlled as needed by offsite agencies. Although Building 6630 is entirely within the confines of KAFB, the need for offsite agencies does exist if there is a significant event which requires offsite assistance. In this situation, the established EPZ would appropriately meet the needs of offsite agencies.

5. What enhancements of the facility and site preparedness stature would be achieved by increasing the selected radius?

   The proposed EPZ radius ensures the involvement and integration of any required response organizations in the planning process. It is not obvious that any increase in the proposed EPZ boundary will provide significant improvement in the level of facility or site preparedness.



Note: The Emergency Planning Zone is denoted by the red line.

Illustration 7-1
6630 Emergency Planning Zone

8.0 EMERGENCY CLASSES, PROTECTIVE ACTIONS, AND EALS

The correlation of event scenarios and estimated consequences developed in Sections 5.0 and 6.0 are used to determine the emergency classes and protective actions that are appropriate for the scenarios, as well as the observable indications (i.e. EALs) to trigger emergency declarations and protective actions.

8.1 Emergency Classes

As mentioned in Section 6.0, the three classes of operational emergencies in ascending order of severity are Alert, Site Area Emergency, and General Emergency. These classes are differentiated by severity for the purpose of specifying appropriate emergency actions, including required response activities and notifications, commensurate with the degree of hazard presented by the event. The three classes of emergencies are defined below.

The following definitions were taken from DOE Order 5500.3A.[54]

8.1.1 Alert

"An Alert shall be declared when events are predicted, are in progress, or have occurred that result in one or more of the following:

- An actual or potential substantial degradation in the level of control over hazardous materials (radiological and non-radiological).

  The radiation dose from any release to the environment of radioactive material or a concentration in air of other hazardous material is expected to exceed either:

  1. The applicable Protective Action Guide or Emergency Response Planning Guideline at or beyond 30 meters from the point of release to the environment or

  2. A site-specific criterion corresponding to a small fraction of the applicable Protective Action Guide or Emergency Response Planning Guideline at or beyond the facility boundary or exclusion zone boundary.

- It is not expected that the applicable Protective Action Guideline will be exceeded at or beyond the facility boundary or exclusion zone boundary.

- An actual or potential substantial degradation in the level of safety or security of a facility or process that could, with further degradation produce a Site Area Emergency or General Emergency."

"Declaration of an Alert does not necessarily require the activation of response centers, but does require availability of personnel and resources to:

- Continuously assess pertinent information for DOE decisionmakers, offsite authorities, the public, and other appropriate entities;

- Conduct appropriate assessments, investigations, or preliminary sampling and monitoring;

- Mitigate the severity of the occurrence or its consequences; and

- Prepare for other response actions should the situation become more serious, requiring emergency response organizations to mobilize or activate resources."

8.1.2 Site Area Emergency

"A Site Area Emergency shall be declared when events are predicted, in progress, or have occurred that result in one or more of the following situations:

- An actual or potential major failure of functions necessary for the protection of workers or the public. The radiation dose from any release of radioactive material is expected to exceed the applicable Protective Action Guide of Emergency Response Planning Guideline beyond the facility boundary of exclusion zone boundary. The Protective Action Guide or Emergency Response Planning Guideline is not expected to be exceeded at or beyond the site boundary.

- An actual or potential threat to the integrity of a nuclear weapon, component, or test device that may adversely impact the health and safety of workers in the immediate area, but not the public.

- Actual or potential major degradation in the level of safety of security of a facility or process that could, with further degradation, produce a General Emergency."

"Declaration of a Site Area Emergency requires the same response as an Alert plus:

- Initiation of predetermined protective actions for onsite personnel;

- Notification and assembly of emergency response personnel and equipment to activate response centers and to establish communications, consultation, and liaison with offsite authorities;

- Provisions of information to the public and the media;

- Implementation of assistance in any evacuations and sheltering; and

- Mobilization of appropriate emergency response groups or protective/security forces for immediate dispatch should the situation become more serious."

8.1.3 General Emergency

"A General Emergency shall be declared when events are predicted, in progress, or have occurred that result in one or more of the following situations:

- Actual or imminent catastrophic reduction of facility safety or security systems with potential for the release of large quantities of hazardous materials (radiological and nonradiological) to the environment. The radiation dose from any release of radioactive material or a concentration in air from any release of other hazardous material is expected to exceed the applicable Protective Action Guide or Emergency Response Planning Guideline at or beyond the site boundary.

- Actual or likely catastrophic failures in safety or security systems threatening the integrity of a nuclear weapon, component, or test device that may adversely impact the health and safety of workers and the public."

"Declaration of a General Emergency requires the same response as for a Site Area Emergency plus:

- The notification, mobilization, and dispatch of all appropriate response personnel and equipment, including appropriate DOE emergency response assets, and liaison with offsite authorities for the recommendation of predetermined public protective actions."

8.2 Carbon Monoxide Release Events and EALs

The consequence analysis performed in Section 6.0 identified the following conditions which could precipitate an alert involving the carbon monoxide associated with Building 6630. The EAL involves:

- Any condition which could breach the primary barrier of the carbon monoxide associated with Building 6630.

Table 8.2
Carbon Monoxide Release Events and EALs

EAL	As Indicated By	Emergency Classification
One 100 cubic foot cylinder filled with carbon monoxide broken during use/transport	*Visual* = damaged gas cylinder *Auditory* = hissing container	Alert (worst case meteorological conditions)

8.3 Protective Actions

The recommended protective action involving all release scenarios inside Building 6630 (i.e. chemical spill, fire, etc.) is evacuation using standard fire drill procedures. Building personnel should be evacuated to a point beyond the site boundary upwind from the incident and a system devised to account for all personnel. The recommended protective actions for other buildings in response to a hazardous materials incident is sheltering in place.

8.3.1 Response

The emergency response personnel in the SNL Emergency Operations Center (EOC) will ensure prompt notification of the DOE Kirtland Area Office (DOE-KAO) emergency response staff and ensure that the coordinated actions of the Sandia and DOE Emergency plans are initiated. Sandia EOC cadre will recommend to DOE-KAO the protective action guidance for the personnel in the affected offsite area to DOE.

DOE-KAO staff will establish and maintain contact with the USAF command structure at Kirtland AFB. DOE-KAO is responsible for the notification to USAF/DOE-HQ, other DOE contractors, and other offsite authorities of the recommended Sandia protective actions, revising or supplementing the Sandia protective actions, or issuing any changes to the protective actions. After emergency response personnel have successfully mitigated the event, the Emergency Response Director will establish a recovery team

and initiate recovery actions. When recovery actions are complete, the Emergency Response Director will recommend termination of the emergency.

9.0 MAINTENANCE AND REVIEW

The Risk Management and NEPA Department is responsible for ensuring that Hazards Assessment Documents are regularly reviewed and maintained.

It is the responsibility of the chemical owners and a responsible facility authority to periodically review Hazards Assessment Documents applicable to their facilities and insure that they accurately reflect any changes in facility design, operations, safety features, inventories of hazardous materials, and features of the surrounding area.

The line organizations should provide information relative to changes in facility design, operation, safety features, inventories of hazardous materials, and features of the surrounding area to the responsible facility authority.

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Appendix A

Building 6630 ChemMaster Inventory

Note: *The following list of chemicals is derived from the SNL/NM ChemMaster Inventory and represent those chemicals that exceeded the screening criteria The quantities herein are listed in various units, as listed in ChemMaster.*

SNL/NM Hazards Project

HA Required : YES | Number of Chemicals: 1

Chemical Inventory

CHEM	LOC_CODE	PHYS_STATE	QTY_UNIT	MQTY	SCR_CRIT
CARBON MONOXIDE, 100%	6630	G	cuft	100	KEEP

Appendix B

ALOHA Dispersion Model Printouts

Procedure for Dispersing Mixtures

Background

The following procedure provides a description for the dispersion of mixtures through the ALOHA dispersion model. ALOHA is designed to model the release rate and dispersion of pure chemicals only. It is difficult for a model like ALOHA to correctly predict the behavior of a mixture of chemicals. However, for the purpose of emergency planning, ALOHA serves a vital role in estimating the distance at which protective actions should be initiated.

The current process used to model the release of mixtures first requires a determination of the percent of hazardous material in the total mixture and releasing that percentage (quantity) as a pure chemical through ALOHA. To calculate the percentage of the hazardous material, multiply the total quantity of the mixture by the percentage of hazardous material in the mixture. The resulting quantity is then run on ALOHA as a direct source (for a gas mixture), or a puddle source (for a liquid mixture). The calculated results depict the most conservative estimate of the behavior of the chemical for emergency planning purposes.

Any specific calculations performed can be found in Appendix C.

Release Designation	
CO-1	

CARBON MONOXIDE

A ten minute release of 100 cubic feet of carbon monoxide due to an accident during use or transportation.

Worst Case	*100 cubic feet* *Meteorological Conditions*

SITE DATA INFORMATION:
Location: ALBUQUERQUE, NEW MEXICO
Building Air Exchanges Per Hour: 60 (User specified)
Date and Time: Fixed at January 1, 1996 0900 hours

CHEMICAL INFORMATION:
Chemical Name: CARBON MONOXIDE
Molecular Weight: 28.01 kg/kmol
TLV-TWA: 25.00 ppm IDLH: 1500.00 ppm
Footprint Level of Concern: 350 ppm
Boiling Point: -191.45° C
Vapor Pressure at Ambient Temperature: greater than 1 atm
Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC INFORMATION: (MANUAL INPUT OF DATA)
Wind: 1 meters/sec from 0° true
Inversion Height: 500 feet
Stability Class: F Air Temperature: 20° F
Relative Humidity: 5% Ground Roughness: Open country
Cloud Cover: 1 tenths

SOURCE STRENGTH INFORMATION:
Direct Source: 10 cubic feet/min
Source Height: 0
Source State: Gas
Source Temperature: equal to ambient
Source Pressure: equal to ambient
Release Duration: ALOHA limited the duration to 1 hour
Release Rate: 302 grams/min
Total Amount Released: 18.1 kilograms
Note: This chemical may flash boil and/or result in two phase flow.
Use both dispersion modules to investigate its potential behavior.

FOOTPRINT INFORMATION:
Dispersion Module: Gaussian
User specified LOC: 350 ppm
Max Threat Zone for LOC: 76 meters
Max Threat Zone for IDLH: 36 meters
Note: Footprint was not drawn because
effects of near-field patchiness make plume
presentation unreliable for short distances.

TIME DEPENDENT INFORMATION:
Concentration Estimates at the point:
Downwind: 30 meters
Off Centerline: 0 meters
Max Concentration:
Outdoor: 2,190 ppm
Indoor: 2,190 ppm
Note: Indoor graph is shown with a dotted line.

SITE DATA INFORMATION:
Location: ALBUQUERQUE, NEW MEXICO
Building Air Exchanges Per Hour: 60 (User specified)
Date and Time: Fixed at January 1, 1996 0900 hours

CHEMICAL INFORMATION:
Chemical Name: CARBON MONOXIDE
Molecular Weight: 28.01 kg/kmol
TLV-TWA: 25.00 ppm IDLH: 1500.00 ppm
Footprint Level of Concern: 500 ppm
Boiling Point: -191.45° C
Vapor Pressure at Ambient Temperature: greater than 1 atm
Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC INFORMATION: (MANUAL INPUT OF DATA)
Wind: 1 meters/sec from 0° true
Inversion Height: 500 feet
Stability Class: F Air Temperature: 20° F
Relative Humidity: 5% Ground Roughness: Open country
Cloud Cover: 1 tenths

SOURCE STRENGTH INFORMATION:
Direct Source: 10 cubic feet/min
Source Height: 0
Source State: Gas
Source Temperature: equal to ambient
Source Pressure: equal to ambient
Release Duration: ALOHA limited the duration to 1 hour
Release Rate: 302 grams/min
Total Amount Released: 18.1 kilograms
Note: This chemical may flash boil and/or result in two phase flow.
Use both dispersion modules to investigate its potential behavior.

FOOTPRINT INFORMATION:
Dispersion Module: Gaussian
User specified LOC: 500 ppm
Max Threat Zone for LOC: 63 meters
Max Threat Zone for IDLH: 36 meters
Note: Footprint was not drawn because effects of near-field patchiness make plume presentation unreliable for short distances.

TIME DEPENDENT INFORMATION:
Concentration Estimates at the point:
Downwind: 30 meters
Off Centerline: 0 meters
Max Concentration:
Outdoor: 2,190 ppm
Indoor: 2,190 ppm
Note: Indoor graph is shown with a dotted line.

Release Designation
CO-2

CARBON MONOXIDE

A ten minute release of 100 cubic feet of carbon monoxide due to an accident during use or transportation.

100 cubic feet
Average Meteorological Conditions

SITE DATA INFORMATION:
Location: ALBUQUERQUE, NEW MEXICO
Building Air Exchanges Per Hour: 60 (User specified)
Date and Time: Fixed at January 1, 1996 0900 hours

CHEMICAL INFORMATION:
Chemical Name: CARBON MONOXIDE
Molecular Weight: 28.01 kg/kmol
TLV-TWA: 25.00 ppm IDLH: 1500.00 ppm
Footprint Level of Concern: 350 ppm
Boiling Point: -191.45° C
Vapor Pressure at Ambient Temperature: greater than 1 atm
Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC INFORMATION: (MANUAL INPUT OF DATA)
Wind: 4 meters/sec from 0° true
Inversion Height: 500 feet
Stability Class: C Air Temperature: 75° F
Relative Humidity: 25% Ground Roughness: Open country
Cloud Cover: 3 tenths

SOURCE STRENGTH INFORMATION:
Direct Source: 10 cubic feet/min
Source Height: 0
Source State: Gas
Source Temperature: equal to ambient
Source Pressure: equal to ambient
Release Duration: ALOHA limited the duration to 1 hour
Release Rate: 271 grams/min
Total Amount Released: 16.3 kilograms
Note: This chemical may flash boil and/or result in two phase flow.
Use both dispersion modules to investigate its potential behavior.

FOOTPRINT INFORMATION:
Dispersion Module: Gaussian
User specified LOC: 350 ppm
Max Threat Zone for LOC: 10 meters
Max Threat Zone for IDLH: less than 10 meters(10.9 yards)
Note: Footprint was not drawn because
effects of near-field patchiness make plume
presentation unreliable for short distances.

TIME DEPENDENT INFORMATION:
Concentration Estimates at the point:
Downwind: 30 meters
Off Centerline: 0 meters
Max Concentration:
Outdoor: 39.7 ppm
Indoor: 39.7 ppm
Note: Indoor graph is shown with a dotted line.

SITE DATA INFORMATION:
Location: ALBUQUERQUE, NEW MEXICO
Building Air Exchanges Per Hour: 60 (User specified)
Date and Time: Fixed at January 1, 1996 0900 hours

CHEMICAL INFORMATION:
Chemical Name: CARBON MONOXIDE
Molecular Weight: 28.01 kg/kmol
TLV-TWA: 25.00 ppm IDLH: 1500.00 ppm
Footprint Level of Concern: 500 ppm
Boiling Point: -191.45° C
Vapor Pressure at Ambient Temperature: greater than 1 atm
Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC INFORMATION: (MANUAL INPUT OF DATA)
Wind: 4 meters/sec from 0° true
Inversion Height: 500 feet
Stability Class: C Air Temperature: 75° F
Relative Humidity: 25% Ground Roughness: Open country
Cloud Cover: 3 tenths

SOURCE STRENGTH INFORMATION:
Direct Source: 10 cubic feet/min
Source Height: 0
Source State: Gas
Source Temperature: equal to ambient
Source Pressure: equal to ambient
Release Duration: ALOHA limited the duration to 1 hour
Release Rate: 271 grams/min
Total Amount Released: 16.3 kilograms
Note: This chemical may flash boil and/or result in two phase flow.
Use both dispersion modules to investigate its potential behavior.

FOOTPRINT INFORMATION:
Dispersion Module: Gaussian
User specified LOC: 500 ppm
Max Threat Zone for LOC: less than 10 meters(10.9 yards)
Max Threat Zone for IDLH: less than 10 meters(10.9 yards)
Note: Footprint was not drawn because
effects of near-field patchiness make plume
presentation unreliable for short distances.

TIME DEPENDENT INFORMATION:
Concentration Estimates at the point:
Downwind: 30 meters
Off Centerline: 0 meters
Max Concentration:
Outdoor: 39.7 ppm
Indoor: 39.7 ppm
Note: Indoor graph is shown with a dotted line.

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